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A design and performance analysis for the Hot Primary Heat Exchanger (HPX) using numerical analysis

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THESIS

A DESIGN AND PERFORMANCE ANALYSIS FOR THE HOT PRIMARY HEAT EXCHANGER (HPX) USING NUMERICAL ANALYSIS

by
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June, 1995

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A DESIGN AND PERFORMANCE ANALYSIS FOR THE HOT PRIMARY HEAT EXCHANGER (HPX) USING NUMERICAL ANALYSIS

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ABSTRACT

The Hot Primary Heat Exchanger (HPX), a key component of the ThermoAcoustic Life Sciences Refrigerator, consists of a tube and fin design. The tubing is bent into a serpentine pattern and overlayed on a screen of copper fins. The serpentine pattern results in several flow reversals and complex internal flow geometries within the heat exchanger. The fins are not consistently of uniform length and generally have heat rejection at both ends. This design results in a forced-cooled, single stack cold plate configuration with unequal temperatures at each end of the fin. The analysis of this configuration requires a methodology based upon the existence of an adiabatic point somewhere along the fin between the prime surfaces. Once the location of this adiabatic point is known, the cold plate may be treated on the basis of two isolated surfaces having fins with adiabatic tips. The goal of this thesis is to provide design analysis and performance predictions for the Hot Primary Heat Exchanger (HPX) using numerical analysis of the tube and fin arrangement of the HPX.

TABLE OF CONTENTS

LIST OF SYMBOLS, ACRONYMS, AND/OR ABBREVIATIONS

ROMAN LETTER SYMBOLS

A	area of heat flow path
b	fin height [m]
c	specific heat capacity [kJ/kg-K]
d	diameter [m]
h	heat transfer coefficient [W/m^2-K]
$\mathbf{K}$	node conductance matrix
K	elements of the matrix $\mathbf{K}$
k	thermal conductivity [W/m-K]
L	length of channel (fin length) [m]
ΔL	length between conductance nodes [m]
m	fin performance factor [m^{-1}]
n	number of fins
Nu	Nusselt number [dimensionless]
P	wetted perimeter [m]
Pr	Prandtl number [dimensionless]
q	heat flow [W]
R	radius [m]
Re	Reynolds number [dimensionless]
R_θ	temperature excess ratio [dimensionless]
T	temperature [°C]
ΔT	temperature difference [°C]
t	elements of the temperature matrix $\mathbf{T}$
w	weight flow [kg/hr]
Y	thermal admittance [W/K]

GREEK LETTER SYMBOLS

$\boldsymbol{\beta}$	a linear transformation matrix
γ	element of the matrix $\boldsymbol{\Gamma}$
$\boldsymbol{\Gamma}$	a linear transformation matrix
δ	fin width or thickness [m]
θ	temperature excess [K]
Λ	$\Lambda = e^{mb}$
μ	dynamic viscosity
τ	element of the matrix $\boldsymbol{\beta}$

SUBSCRIPTS

a	designates fin tip
avg	designates average
b	designates fin base
c	designates cross-sectional area
cond	designates heat flow due to conductivity
conv	designates heat flow due to convection
e	designates effective diameter
f	designates fin surface
F	designates fluid quantities

ideal	designates ideal values
in	designates input condition
inner	designates inner radius
max	designates maximum quantity
o	designates characteristic value
outer	designates outer radius
p	designates prime surface
s	designates surface area

ACRONYMS

CPX	Cold Primary Heat Exchanger
EHX	Experimental Heat Exchanger
HPX	Hot Primary Heat Exchanger
IRE	Insulated Refrigeration Enclosure
TALSR	ThermoAcoustic Life Sciences Refrigerator

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I. INTRODUCTION

The Hot Primary Heat Exchanger (HPX), a key component of the ThermoAcoustic Life Sciences Refrigerator (TALSR), consists of a tube and fin design. The tubing is bent into a serpentine pattern and overlayed on a screen of copper fins. This configuration results in several flow reversals and complex internal gas side flow geometries within the heat exchanger. The fins are not consistently of uniform length and generally have heat rejection at unequal temperatures on each end of the fin. This design results in a forced-cooled, single stack cold plate configuration. The TALSR uses forced convection with an acoustic oscillator providing internal flow through channels created within the configuration of the HPX.

The first formal analyses of the cold plate configuration was provided by Mark and Stephenson (1954) and Kraus (1961). These analyses provided expressions for the efficiency of the cold plate for the case of heat loading on one side. Subsequently, Kern and Kraus (1972) looked at the single stack cold plate with heat input on only one, and on both sides. Incropera and Dewitt (1981) presented a classical textbook culmination of extended surface research and general conduction analysis for fins of uniform cross-sectional area. An application of extended surface principles and research was used by Garrett (1992) to evaluate the forced convective thermal performance of the HPX. Most recently, Pieper and

Kraus (1995) looked at the cold plate configuration with asymmetric heat loading and proposed dividing the plate into two fins, each possessing an adiabatic tip for analysis purposes. This permits a more accurate representation of the performance of the cold plate configuration.

The goal of this thesis is to utilize the results of Pieper and Kraus (1995) to provide design analysis and performance predictions for the Hot Primary Heat Exchanger (HPX) using a numerical optimization of the serpentine tube and fin arrangement in the HPX.

The serpentine pattern of the copper tubing in the HPX is unique when compared to a majority of the tube and fin heat exchangers currently in use. A vast majority of current applications involve parallel fluid flow in tubes through a matrix of fins to provide the required heat transfer. This results in fairly uniform base temperatures at each end of the fin. In contrast, the serpentine tubing in the HPX results in non-uniform base temperatures due to increasing temperatures along the length of the tube. Research into the thermal performance of a non-uniform base temperature design is limited and on-going, however, a successful application of this configuration has been achieved on a large scale at the WyoDak energy facility in Gillete Wyoming, shown in Figure 1.

Chapter II of this thesis is used to present fundamental heat transfer concepts, and extended surface evaluation techniques. Chapter III provides a physical description of

the ThermoAcoustic Life Sciences Refrigerator (TALSR) and discusses the role of the Hot Primary Heat Exchanger in the heat transfer cycle of the TALSR. Chapter IV details the numerical simulation techniques used in the performance analysis of the HPX. Chapter V presents a discussion on efficiency modeling and the factors affecting extended surface efficiencies. Analysis results and conclusions are presented in Chapters VI, and VII respectively.

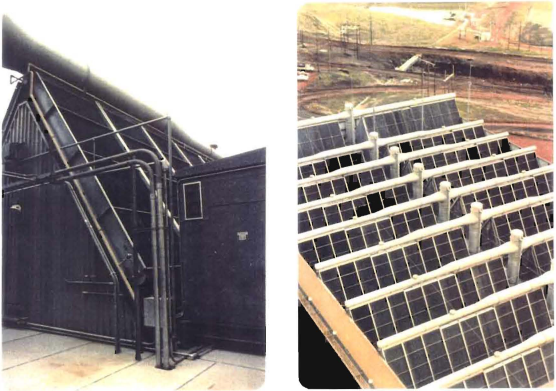


Figure 1: WyoDak Energy Facility in Gillete Wyoming

II. HEAT TRANSFER FROM EXTENDED SURFACES

The convective heat transfer rate of a bare surface may be increased by increasing the surface area through which the convection occurs. This may be accomplished by using surfaces that extend from the bare surface into the surrounding fluid. Naturally, a considerably larger amount of heat can be transferred from or to an extended surface in a given time period than from or to a bare surface. The type of extended surface most commonly used, is termed a fin. The thermal conductivity of the fin material has a strong effect on the temperature distribution along the fin and therefore influences the degree to which the heat transfer rate is enhanced.

A. BASIC HEAT TRANSFER CONCEPTS

Conduction is the heat flow mechanism whereby heat is transferred by molecular diffusion from one part of a medium under the influence of a temperature gradient without a net displacement of the particles that compose the medium. It was Fourier who proposed that the heat flow is directly proportional to the area of the heat flow path and the temperature gradient along the path,

$$q \propto A(dT/dx) \qquad \textbf{(2.1)}$$

Insertion of a proportionality constant yields:

$$q_{cond} = -kA(dT/dx) \tag{2.2}$$

where,

A = area of the heat flow path

k = thermal conductivity of the material

(dT/dx) = change in temperature per unit length

The minus sign assures a positive heat flow in the presence of the required negative temperature gradient.

Convection is a fluid flow process that results in the transfer of heat from or to a confining surface by a flowing fluid. The fluid flow may be induced by buoyancy, density gradients or through the use of mechanical methods. Those methods utilizing mechanical flow generation are termed forced convection.

A second classification of convective heat transfer is as either internal or external. In internal flow the fluid is constrained on all sides by solid boundaries, as in flow through a pipe. In external flow the fluid has at least one side extending to infinity without encountering a solid surface. Heat flow during convection is directly proportional to the temperature difference between the confining surface and the surface area over which the process takes place:

$$q \propto A \, \Delta T \tag{2.3}$$

Insertion of a proportionality factor yields,

$$q_{conv} = hA \, \Delta T \tag{2.4}$$

Equation (2.4) is Newton's law of cooling and *h* is called the convection heat transfer coefficient and encompasses all the effects that influence the convection mode.

B. FIN CONCEPTS

To determine the heat transfer rate associated with a fin, the temperature distribution along the fin must first be obtained. In the temperature distribution analysis, some standard assumptions are made. First, radiation effects are neglected. In addition, the fin is assumed to comply with the well known Murray (1938) and Gardner (1945) assumptions listed in Appendix A. The one dimensional assumption of Murray-Gardner is valid because in most extended surface applications the fins are relatively very thin compared to their height. Thus, the temperature changes in the longitudinal direction are much larger than those in the transverse direction and the one dimensional assumption is satisfactory. The material used in the construction of the fin is characterized by a thermal conductivity, *k*. It is also assumed that the heat transfer coefficient due to convection, *h*, is known. Thus, following the standard, steady state fin characterization of Incropera and Dewitt (1981), it is found that;

$$(k)d(A_c(x)dT/dx)/dx - (h)(dA_s(x)/dx)(T - T_\infty) = 0 \quad \textbf{(2.5)}$$

where A_c is the cross-sectional area, and A_s is the surface

area, both of which may vary with x. Equation (2.5) may be simplified by defining a temperature excess, θ, as,

$$\theta(x) = T(x) - T_\infty \qquad (2.6)$$

where because T_∞ is a constant, $d\theta/dx = dT/dx$. Substituting Equation (2.6) into Equation (2.5), results in;

$$(k)d(A_c(x)d\theta(x)/dx)/dx - (h)(dA_s(x)/dx)\theta(x) = 0 \qquad (2.7)$$

To determine the temperature distribution along the length of an individual fin, it is necessary to solve Equation (2.7) for the specific fin geometry.

For the case of an individual rectangular fin of length b, as shown in Figure 2, consider that the origin of the coordinate is at the fin tip with positive orientation toward the fin base. The fin width is a constant, δ, therefore A_c is a constant and $A_s = Px$, where A_s is the surface area measured from the tip to x and P is the fin perimeter. Thus, $(dA_c/dx) = 0$ and $(dA_s/dx) = P = (2L + 2\delta) \approx 2L$ and Equation (2.7) reduces to;

$$d^2\theta/dx^2 - m^2\theta = 0 \qquad (2.8)$$

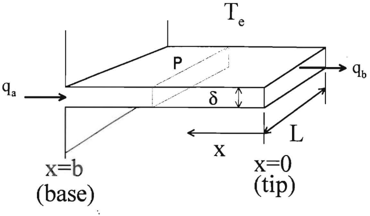


Figure 2: Rectangular longituidinal fin of length b.

where

$$m^2 = 2h/k\delta \tag{2.9}$$

Equation (2.8) is a linear, homogenous, second-order differential equation with constant coefficients. Its general solution is of the form;

$$\theta(x) = C_1e^{mx} + C_2e^{-mx} \tag{2.10}$$

By substitution, it is easily verified that Equation (2.10) is a solution to Equation (2.8).

To evaluate the constants C_1 and C_2 of Equation (2.10), it is necessary to specify initial value data;

$$\theta(x = b) = \theta_b$$

and (2.11)

$$q(x = b) = q_b$$

This makes

$$\theta_b = C_1e^{mb} + C_2e^{-mb} \tag{2.12}$$

and applying $q_b = kA(d\theta_b/dx)$ gives

$$q_b = k\delta mL[C_1e^{mb} - C_2e^{-mb}] \tag{2.13}$$

or

$$q_b = Y_o[C_1e^{mb} - C_2e^{-mb}] \tag{2.14}$$

where $Y_o = k\delta mL$, is called the characteristic thermal admittance of the fin and has the units W/°C.

It is then a matter of algebra to evaluate the constants C_1 and C_2 such that;

$$\theta(x) = \theta_b\cosh(m[b-x]) - (q_b/Y_o)\sinh(m[b-x]) \tag{2.15}$$

and

$$q(x) = \theta_b Y_o\sinh(m[b-x]) + q_b\cosh(m[b-x]) \tag{2.16}$$

Now that the temperature excess and heat flow at any point in the fin have been evaluated, a convenient method of mapping conditions at the fin tip to conditions at the fin base is desired.

For individual fins, Kraus et al. (1978) showed that conditions of heat flow and temperature excess (relative to the presumed constant and uniform temperature environment) at any point on a fin are induced by similar conditions at the fin base. This resulted in the development of a linear transformation that mapped conditions at the fin tip to conditions at the fin base:

$$\begin{bmatrix}\theta_b\\ q_b\end{bmatrix} = \beta\begin{bmatrix}\theta_a\\ q_a\end{bmatrix} = \begin{bmatrix}\tau_{11} & \tau_{12}\\ \tau_{21} & \tau_{22}\end{bmatrix}\begin{bmatrix}\theta_a\\ q_a\end{bmatrix} \tag{2.17}$$

where the matrix β is called the inverse thermal transmission matrix. Its elements are designated as the inverse thermal transmission parameters. A summary of this work is provided in Appendix B.

Applying the development of Kraus et al. (1978) to the rectangular fin of Figure 2, it is seen that the inverse thermal transmission matrix is given by

$$\beta = \begin{bmatrix}\cosh mb & (Z_o)(\sinh mb)\\ Y_o(\sinh mb) & \cosh mb\end{bmatrix} \tag{2.18}$$

where $Y_o = (2hk\delta)^{1/2}L$, $Z_o = 1/Y_o$, and k, L, h, and δ are the thermal conductivity, fin length, heat transfer coefficient, and fin thickness respectively. Thus, this matrix can be used to map conditions at the fin tip to conditions at the fin base

$$\begin{bmatrix}\theta_b\\ q_b\end{bmatrix} = \begin{bmatrix}\cosh mb & (Z_o)(\sinh mb)\\ Y_o(\sinh mb) & \cosh mb\end{bmatrix}\begin{bmatrix}\theta_a\\ q_a\end{bmatrix} \tag{2.19}$$

In addition to developing the linear transformation matrices, Kraus et al. (1978) also proposed that the conventional fin efficiency be abandoned and that single fins be characterized by a single parameter called the thermal transmission ratio, the ratio of the heat entering the fin to the temperature excess at the base of the fin. This was later called the fin input admittance [Kraus (1982)] and was given in the form of a bilinear transformation;

$$Y_{in} = q_b/\theta_a = (\tau_{21} + (q_a/\theta_a)\tau_{22})/(\tau_{11} + (q_a/\theta_a)\tau_{12}) \quad \textbf{(2.20)}$$

The fin input admittance is particularly useful in the analysis and evaluation of finned arrays and will play an important role in the analysis of the HPX.

C. FIN ANALYSIS WITH AXISYMMETRIC HEAT LOADING

Consider the forced cooled cold plate shown in Figure 3 and observe that the single fin of total height b has been subdivided into two fins with fin heights b_1 and b_2, to allow for the fact that the temperature differences at its opposite ends may not be equal. Note that the temperature excess, θ, is defined as the difference between the temperature at any point on the fin, T, and the temperature of the coolant fluid, T_∞, as given in Equation (2.6).

As shown in Figure 3, the origins of the fin height coordinates, x_1 and x_2, are taken at the tips of fin 1 and fin

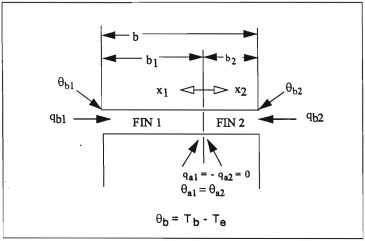


Figure 3: Forced cooled cold plate configuration used in axisymmetric heat loading analysis

2 with a positive orientation from fin tip to fin base. The fin heights, b_1 and b_2, are chosen such that no heat crosses the interface between fin 1 and fin 2, thus creating an adiabatic fin tip condition. This is characterized by a linear transformation of Equation (2.19) for the longitudinal fin of rectangular profile shown, given by;

$$\begin{bmatrix} \theta_{b1} \\ q_{b1} \end{bmatrix} = \begin{bmatrix} \cosh mb_1 & Z_o(\sinh mb_1) \\ Y_o(\sinh mb_1) & \cosh mb_1 \end{bmatrix} \begin{bmatrix} \theta_{a1} \\ q_{a1} \end{bmatrix} \tag{2.21}$$

and

$$\begin{bmatrix} \theta_{b2} \\ q_{b2} \end{bmatrix} = \begin{bmatrix} \cosh mb_2 & Z_o(\sinh mb_2) \\ Y_o(\sinh mb_2) & \cosh mb_2 \end{bmatrix} \begin{bmatrix} \theta_{a2} \\ q_{a2} \end{bmatrix} \tag{2.22}$$

The cold plate configuration of Figure 3 is subject to the continuity and compatibility conditions at the interface between fins 1 and 2. These conditions require an adiabatic interface between b_1 and b_2 and are given in matrix form as;

$$\begin{bmatrix} \theta_{a1} \\ q_{a1} \end{bmatrix} = \begin{bmatrix} \theta_{a2} \\ -q_{a2} \end{bmatrix} = \begin{bmatrix} \theta_a \\ 0 \end{bmatrix} \tag{2.23}$$

If $\theta_{b1} \neq \theta_{b2}$, symmetry will not apply and the fin heights b_1 and b_2 will not be equal ($b_1 \neq b_2$).

In order to determine fin lengths b_1 and b_2, Equations (2.21) and (2.22) may be expanded using the conditions of Equation (2.23). In particular with $\theta_{a1} = \theta_{a2} = \theta_a$, the following equations are derived,

$$\theta_{b1} = [\cosh mb_1]\theta_a \tag{2.24}$$

$$\theta_{b2} = [\cosh mb_2]\theta_a \tag{2.25}$$

Equation (2.24) and Equation (2.25) show that the base temperature excesses for b_1 and b_2 are related through θ_a, thus, a temperature excess ratio (R_θ) for a given cold plate configuration may be defined as:

$$R_\theta = \theta_{b1}/\theta_{b2} = [\cosh mb_1]/[\cosh mb_2] \tag{2.26}$$

The hyperbolic cosines of Equation (2.26) can also be represented as exponentials;

$$R_\theta = (e^{mb1} + e^{-mb1})/(e^{mb2} + e^{-mb2}) \tag{2.27}$$

Using the observation from Figure 3, that $b_2 = b - b_1$, it is a matter of algebra to show that;

$$R_\theta = (\Lambda^2 + e^{2m(b2)})/(\Lambda[e^{2m(b2)} + 1]) \tag{2.28}$$

where

$$\Lambda = e^{mb} \tag{2.29}$$

The value of b_2 for a given value of R_θ can then be found by re-arranging Equation (2.28) to provide;

$$b_2 = (1/2m)(\ln[\Lambda(\Lambda - R_\theta)/(R_\theta\Lambda - 1)]) \tag{2.30}$$

An evaluation of R_θ using Equation (2.30) confirms that if R_θ=1 because $\theta_{b1} = \theta_{b2}$, then because of symmetry, b_2 must equal half of the total fin height. In addition , the value of R_θ for b_2=0 can be found directly from Equation (2.28),

$$(R_\theta)_{max} = (\Lambda^2 + 1)/(2\Lambda) \tag{2.31}$$

and similarly for b_2=b,

$$(R_\theta)_{min} = (2\Lambda)/(\Lambda^2 + 1) \tag{2.32}$$

If R_θ is not within the domain of values specified by Equations (2.31) and (2.32) the fin is then treated as a single fin without an adiabatic point. However, for the HPX model, the R_θ values are always within this domain and the single fin analysis is not required.

Once b_2 is known, b_1 is easily found through a simple subtraction procedure ($b_1 = b - b_2$). With both b_1 and b_2

known, the cold plate may be treated on the basis of two isolated surfaces having fins with adiabatic tips, treating each fin individually as though the other were not present. One surface is governed by b_1 with θ_{b1} specified, and the other is governed by b_2 with θ_{b2} specified. Thus, there are two entities, each with a prime surface and each with a fin, and these surfaces may be treated individually as if the other were not present.

The performance of each prime surface, and fin (b_1 or b_2) combination depends on the total input admittance of the pair. The total input admittance, Y_{in}, is just the sum of the prime surface and fin input admittances,

$$Y_{in} = Y_{in,p} + Y_{in,f} \tag{2.33}$$

where the subscripts, *p* and *f* refer to the prime surface and the fin, respectively, and where both prime and fin base surfaces are operating at θ_b.

The prime surface input admittance is determined by its convective dissipation

$$Y_{in,p} = hS_p \tag{2.34}$$

where as seen from Figure 4,

$$S_p = (W - \delta)L \tag{2.35}$$

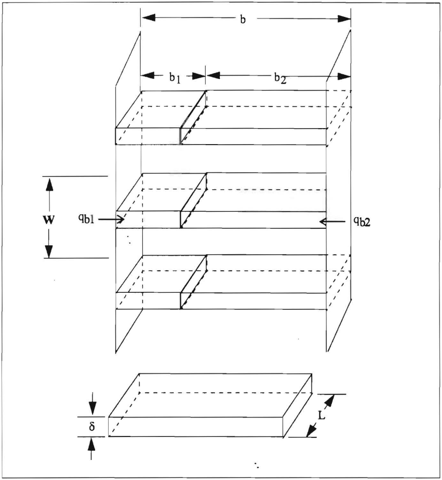


Figure 4: Schematic of single stack, cold plate heat transfer geometry.

which accounts for the footprint occupied by the fin.

The fin input admittance is derived from the fin β-matrix given by Equation (2.18). Because the height b_2 is based upon the determination of an adiabatic point, $Y_{in,f}$ is established by realizing that for $q_a = 0$ Equation (2.20) becomes;

$$Y_{in} = q_b/\theta_a = \tau_{21}/\tau_{11} = Y_o \sinh(mb)/\cosh(mb) \qquad \textbf{(2.36)}$$

which for the fin governed by b_2, becomes

$$Y_{in,f} = Y_o \tanh(mb_2) \qquad \textbf{(2.37)}$$

Then, if the temperature excesses are specified so that R_θ leads to the establishment of b_2, the heat dissipation is obtained from;

$$q_b = Y_{in}\theta_b \qquad \textbf{(2.38)}$$

This section provides the basis for an accurate thermal performance model needed in the simulation of the heat transfer process in the TALSR discussed in the next chapter.

III. THE THERMOACOUSTIC LIFE SCIENCES REFRIGERATOR

The ThermoAcoustic Life Sciences Refrigerator (TALSR), developed at Naval Postgraduate School, was motivated by the desire to replace the Freon 512 vapor compression refrigeration system currently used on board the Space Shuttle. The TALSR provided a safer alternative due to the fact that it does not use chlorofluorocarbons (CFCs) and therefore could not potentially contaminate the small confined area of the Space Shuttle. In addition, the TALSR also provides the potential for higher reliability, over the current system, because it has no sliding seals and thus requires no lubrication. The ThermoAcoustic Life Sciences Refrigerator uses a complex thermal transport subsystem to remove heat from the Insulated Refrigeration Enclosure (IRE) of the Space Shuttle.

A. THERMAL SYSTEMS OVERVIEW

Heat is removed from the IRE by a Liquid-Air Heat Exchanger fabricated by the Modine Manufacturing Company. It is then transported through two thermoacoustic heat pumps, connected in series, by a mechanically pumped cold heat exchange fluid. The internal architecture of each heat pump consists of a Cold Primary Heat Exchanger (CPX), a Hot Primary Heat Exchanger (HPX), and an Electrodynamic Driver. The Electrodynamic Driver acoustically oscillates an internal

working fluid in each heat pump thereby creating internal gas side flow for both the HPX and the CPX. It is known that the heat transfer between surfaces can be enhanced using longitudinal acoustic waves [Vainshtein (1995)]. This internal gas side flow is used by the Cold Primary Heat Exchanger to remove heat from the cold-side exchange fluid, and transport it to the HPX. The HPX then transfers the heat removed from the cold-side exchange fluid into a secondary cooling loop. This secondary cooling loop transports the heat to the internal environment of the Space Shuttle via an Experimental Heat Exchanger (EHX). A schematic diagram of the series fluid flow through the TALSR thermal transport subsystem is shown in Figure 5 [Garrett (1992)].

B. THE HOT PRIMARY HEAT EXCHANGER (HPX)

The Hot Primary Heat Exchanger uses an acoustically oscillating medium to transport heat and must therefore be analyzed differently from most compact heat exchangers. The most significant difference between standard compact heat exchanger analysis and acoustical heat exchanger analysis is the fact that the acoustically oscillating gas parcels only move a limited distance before reversing their direction of flow. The consequence of this periodic flow reversal is that an increase in the effective surface area for heat transfer cannot arbitrarily be achieved by simply increasing the length of the heat exchange surfaces (fins) in the direction of flow.

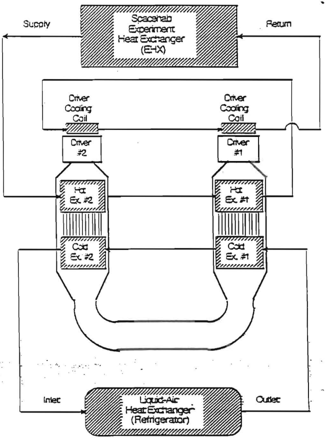


Figure 5: Schematic diagram of the series fluid flow through the Hot and Cold Primary Heat Exchangers. [Garrett (1992)]

Garrett (1992) has shown that the effective area over which heat transfer will take place is limited by the peak-to-peak excursions of the gas parcels over the heat exchange surface. Thus, heat exchange surfaces, which have a length in the flow direction equal to the peak-to-peak displacement of the gas, provide the maximum effective surface area for heat transfer.

The HPX utilizes copper tubing bent into a serpentine pattern and then soldered or furnace brazed on a screen of copper fins, as shown in Figure 6 [Garrett (1992)]. In this configuration, the fins are not of uniform length and for a majority of the fins, there is heat rejection at both ends. This design results in two parallel paths by which the fluid contained within the copper tubing can remove heat from the acoustically oscillating gas. The primary path is through the fins which are bonded to the tube. The fins represent the primary path because they have a greater surface area than the outside diameter of the tubing and because they are designed to have a length in the flow direction approximately equal to the peak-to-peak displacement of the gas. The secondary path is due to the direct convection of the gas around the tubing. This path also provides some useful heat transfer and requires consideration in the thermal analysis of the HPX. A schematic representation of the thermal resistances in the primary heat exchanger energy flow path is shown in Figure 7 [Garrett (1992)]. The tubing for the HPX is standard, circular cross-section, soft copper tubing, with an outer diameter (OD) of

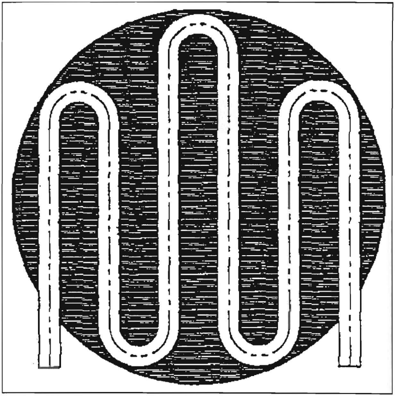


Figure 6: HPX design configuration [Garrett (1992)]

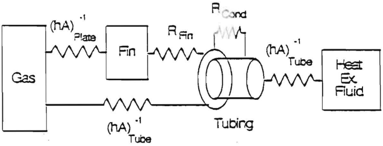


Figure 7: Schematic representation of thermal resistances in the HPX flow path. [Garrett (1992)]

0.635 cm and a wall thickness of 0.076 cm. The HPX has an inner diameter of 11 cm. Table 1 provides a list of the geometrical constraints and heat transfer characteristics used in the analysis of the HPX.

The physical design of the HPX can therefore be modeled as a forced-cooled, single stack cold plate configuration with unequal temperatures at each end of the fin. Thus, an analysis of the HPX can be completed using the derived relationships for cold plates with axisymmetric heat loading.

Symbol	Description	Value	Reference
c_p	specific heat capacity of water	4.182 kJ/kg-K	Incropera and Dewitt (1981)
δ	Fin thickness	0.0152 cm	Garrett (1992)
h_F	Fluid heat transfer coefficient	12600 W/m^2-K	Garrett (1992)
k	thermal conductivity of copper	401 W/m-K	Garrett (1992)
L	Fin width (channel length)	0.3175 cm	Garrett (1992)
Pr	Prandtl number	0.7068	Garrett (1992)
Re	Reynolds number	1900	Garrett (1992)
R_{inner}	Inner radius of copper tubing	0.2413 cm	Garrett (1992)
R_{outer}	Outer radius of copper tubing	0.3175 cm	Garrett (1992)
μ	mean dynamic viscosity	190 x 10^{-7} N-s/m^2	Incropera and Dewitt (1981)
μ_s	surface dynamic viscosity	184 x 10^{-7} N-s/m^2	Incropera and Dewitt (1981)

Table 1: A summary of the physical constraints and heat transfer properties used in the analysis of the HPX

C. COMPUTER MODELING OF THE HEAT TRANSFER PROCESS

Once an accurate thermal model has been obtained, an efficient and reliable method of analyzing the heat transfer processes occurring within the heat exchanger is required. This is accomplished through the use of Steady State Thermal Analyzer software version 2.2 provided by InterCept Software. The model builder provides the user with the means to model the physical configuration of interest in order to provide the thermal analyzer with an input file. The thermal analyzer then takes the input file and produces an output file containing a summary of the temperatures within the configuration.

The model building process begins with a drawing of the configuration and a subdivision of it into small but finite subvolumes. Each subvolume is presumed isothermal and the centers of each subvolume are then representative of the entire subvolume. These centers are referred to as nodes and are connected to adjacent nodes through branches consisting of various forms of thermal conductance. These conductance forms are dependent on the mode of heat transfer between adjoining pairs of nodes. The various heat transfer modes available to the user include conduction, laminar free convection, radiation, forced convection, and fluid flow.

Each node can also be connected to a constant temperature, a constant heat input, or a temperature dependent heat input with an appropriate tag. Once a sketch

representation of the nodalized model is complete, the comprehensive node connection data is ready to be input into the model builder program. The input for the model builder program begins with node 1, and the user is asked for information for each connecting node with a greater number. For each connection to an adjacent node, the user must specify the mode of heat transfer with a tag number. After specifying the connecting node and tag, the user is queried as to the whether the conductance will be calculated, input directly, or is the same as an earlier branch. Conductance values are required for each node connection to any higher number node.

Subsequent use of the thermal analysis software results in the writing of n node equations in n unknown temperatures where the nodes are connected by the appropriate thermal conductances. The general solution strategy for these n equations is to then use the nodal conductances of the model to form a set of heat balance equations. In matrix form, this set of heat balance equations has the general form;

$$[K] \quad [T] = [B] \tag{3.1}$$

where **K** is the matrix of conductances, **T** is the node temperatures, and **B** is a matrix composed of constant temperature heat sinks, and/or heat inputs. Many of the conductances are linearized forms of nonlinear expressions for heat transfer by natural convection and other similar heat

transfer modes, therefore, the various terms in the **K** matrix may themselves be functions of temperature. Solution of the **T** matrix therefore, must be by iteration. Node temperatures obtained after each iteration are used to update the temperature dependent terms in the **K** matrix. The thermal analyzer uses a Cholesky factorization [Hamming (1973)] of the **K** matrix to perform this iteration. This iterative solution continues until the change in nodal temperatures between successive iterations is smaller than a user-specified error criteria. Once the iterative solution is obtained, the thermal analyzer writes the temperatures to an output file, where they can be read and analyzed by the user.

IV. PERFORMANCE ANALYSIS

The thermal analysis of the TALSR requires an adequate model capable of determining both the heat transfer characteristics for the complex flow geometries within the HPX, and the values of temperature along the serpentine pattern of the copper tubing. The thermal conductivity of copper, k, the fin thickness, δ, and the channel length, L, are all easily determined from the given material and geometrical considerations of the HPX. Therefore, to complete the thermal analysis, the convection coefficient, h, is required to determine the total input admittance, and the conductance matrix is needed to map base temperature excesses along the length of copper tubing. These remaining values are determined using numerical analysis techniques.

A. HOT PRIMARY GAS SIDE HEAT TRANSFER COEFFICIENT DETERMINATION

The convection heat transfer coefficient, *h*, encompasses all the effects that influence the convection mode. It depends on conditions in the boundary layer, which are influenced by surface geometry, the nature of fluid motion and many of the fluid thermodynamic and transport properties. By considering the magnitude of the factors affecting the heat transfer coefficient, *h*, an appreciation for the complexity in determining its value is obtained. In simple flow situations, solutions for *h* are readily effected mathematically, however,

for situations of complex flow geometries, such as those in the TALSR, the more practical approach involves calculating *h* from empirical equations. The particular form of these equations is obtained by correlating measured convection heat and mass transfer results in terms of appropriate dimensionless groups. The development of the dimensionless group used to determine *h* was performed by Incropera and Dewitt (1981), and resulted in the derivation of the Nusselt number (Nu). The dimensionless Nusselt number provides a measure of the convective heat transfer occurring at the surface. For a prescribed geometry, the Nusselt number is a universal function of x^*, the Reynolds number, and the Prandtl number, where x^* is the dimensionless length of the fluid along the channel. A detailed analysis of these factors will determine the exact correlation to be used in determining the Nusselt number. For the given flow geometry and considerations of the HPX, the Reynolds number is given by Garrett (1992) to be 1900, therefore, flow through the coolant channel remains in the laminar region. In the absence of strict correlations for oscillatory flow convection coefficients, a steady flow Nusselt correlation was assumed to provide a suitable representation of heat transfer in the channel. Sieder and Tate (1936) proposed a suitable correlation for laminar flow in tubes and ducts ($[(Re_D Pr D/L)^{1/3})(\mu/\mu_s)^{0.14}] \geq 2$) given by;

$$Nu = 1.86\ (RePr/(L/D))^{1/3}(\mu/\mu_s)^{0.14} \quad \textbf{(4.1)}$$

where μ and μ_s are the average dynamic viscosity and the surface dynamic viscosity respectively. From knowledge of the Nusselt number, the convection coefficient may now be found using;

$$Nu = (hd_e/k_F) \quad \textbf{(4.2)}$$

where d_e is the effective diameter of a non-circular duct through which the fluid passes. Replacing D with d_e in Equation (4.1) and combining with Equation (4.2) results in

$$h = (Nu(k_F)/d_e) = (1.86k_F/d_e)(RePr/(L/de))^{1/3}(\mu/\mu s)^{0.14} \quad \textbf{(4.3)}$$

Then using the values of L, Re and Pr specified in Table 1, and realizing that for air $(\mu/\mu_s)^{0.14} \sim 1$ over the temperature range of interest for the HPX it is easily shown that;

$$h = (7.9 \times 10^{-3})/d_e^{2/3} \quad \textbf{(4.4)}$$

where h is given in Watts/cm^2-K. The effective diameter, d_e, is defined as;

$$d_e = (4A_C/P) \quad \textbf{(4.5)}$$

where A_c and P are the flow cross-sectional area and the wetted perimeter respectively. A rectangular duct flow geometry is assumed for the TALSR based on the large radius of curvature of the HPX and the small spacing between fins, thus as shown in Figure 4;

$$d_e = 2zb/(b + z) \qquad (4.6)$$

where $z = (W - \delta)/2$, and $b = b_1 + b_2$. The value of b varies by location within the HPX, as shown in Figure 5, and results in corresponding changes in the convection coefficient for each location. Therefore the value of h in Equation (4.4) must be considered independently for each location along the copper tubing. This significantly increases the complexity of the analysis.

B. TEMPERATURE EXCESS DETERMINATION

Determination of temperature excess variation with location along the length of copper tubing is also required to adequately complete the analysis of the TALSR. An accurate model of the heat transfer processes shown in Figure 7 is required to determine this variation.

Application of the model builder program THANSS, located within the Steady State Thermal Analyzer software, to the TALSR is accomplished by dividing the length of the copper tubing surface into 144 subvolumes of varying size based on

location. Additionally, another 144 nodes are assigned to corresponding fluid nodes within the pipe to account for variations in fluid temperature as it flows through the tubing. A summary of nodal assignments based on location is given in Appendix C. An additional two nodes are required to complete the model. The first node, a constant heat source node, is assigned to the air flowing through the coolant channels created by the tube and fin design. The temperature of the air is considered uniform and constant at 40°C. The second node is used to represent the liquid input temperature at the inlet to the HPX. This temperature is also assumed uniform and constant at a temperature of 25°C.

The general form of the heat flow equations used for all modes of heat transfer considered within the HPX is;

$$q = K(T_1 - T_2) \qquad \textbf{(4.7)}$$

where K, the conductance, varies in form depending on the mode of heat transfer considered. For the HPX model, four forms of thermal conductance are required to define the various modes of heat transfer occurring within the HPX.

The first conductance is represented as K_1 and is given by;

$$K_1 = kA_c/\Delta L \qquad \textbf{(4.8)}$$

where k is the thermal conductivity, A_c is the cross sectional area, and ΔL is the length between adjacent nodes. This conductance is used to define heat flow between adjacent nodes on the surface of the copper tubing, therefore, the cross sectional area available for heat transfer, A_c, is given by:

$$A_c = \pi(R^2_{outer} - R^2_{inner}) = 0.134 \text{ cm}^2 \tag{4.9}$$

The thermal conductivity of copper (k = 401 W/m-K) was used for all calculations involving K_1.

The second conductance is used in the calculation of the convective heat transfer between nodes on the surface of the copper tubing and corresponding liquid nodes located within the copper tubing. It is denoted as K_2 and is given as:

$$K_2 = h_w A_s \tag{4.10}$$

where h_w is the convective heat transfer coefficient due to water flow through the tube, and A_s is the surface area over which the heat transfer occurs. The given value of h_F for turbulent water flow through the tube is given by Garrett (1992) as 12600 W/m^2-K. The surface area over which the heat transfer occurs is based on the inner radius of the copper tubing and is given by:

$$A_s = 2\pi R_{inner}\Delta L \tag{4.11}$$

where ΔL is identical in value to that used in determining K_1.

The third conductance form, K_3, is used in the determination of the convective heat transfer between adjacent fluid nodes within the tube. It is given as:

$$K_3 = w_F c_F \tag{4.12}$$

where w_F is the fluid weight flow and c_F is its specific heat capacity. This value was calculated for a variety of flow rates (w_F = 68 kg/hr, 149.7 kg/hr, 272.2 kg/hr, 362.9 kg/hr) through the tubes, and the thermal performance of each flow rate was analyzed. A constant value of 4.182 kJ/kg-K was used for the specific heat capacity of water in all calculations of K_3.

The fourth conductance term necessary to analyze the thermal model is used in the calculation of the heat transfer from the surface of the tubing, to the surrounding environment via both the prime and fin surfaces. This term is the most difficult of the conductance forms to determine, and requires a return to the principles presented in the single stack cold plate analysis. Equation (2.33) is written in the form of the general heat equation used by the thermal analysis software in its calculations where;

$$K_4 = Y_{in} = Y_{in,p} + Y_{in,f} \tag{4.13}$$

and

$$\theta_a = (T_a - T_e) = (T_1 - T_2) \tag{4.14}$$

Therefore, the fourth conduction term is the sum of the prime surface and fin input admittances, and the temperature difference is given in terms of a temperature excess at the base of the fin. Applying this conductance form to the HPX requires consideration of the length, ΔL, between adjacent nodes. The length between adjacent nodes determines both the number of fins, and the amount of prime surface associated with each node. The ΔL in the analysis model is varied with location along the copper tubing as shown in Appendix C. Once ΔL is determined, the resulting number of fins, n, and prime surface area may be used with the determined value of *h* to give;

$$K_4 = hn(W - \delta)L + nY_o \tanh(mb_2) \tag{4.15}$$

where $n = \Delta L/W$.

Once the model provides the required data to satisfy the K-value equations, the solution of the thermal conductance matrix is straightforward and ideally suited to a spreadsheet

application. The calculated K-values are then used as input to the thermal analyzer to form a series of node connection data. The spreadsheet calculations and resulting node connection data for each case considered is provided in Appendix D. In the HPX model, the tube water inlet temperature and the oscillating air temperature are assigned constant values. Additionally, as mentioned earlier, 144 nodes were assigned to locations along the copper tubing (nodes 1-144) and 144 corresponding nodes (nodes 145-288) were assigned to the centerline liquid temperature within the tubing.

In the initial development, it was assumed that all fin pairs were shared equally ($\theta_{b1} = \theta_{b2}$). This condition is the easiest to model, because fin sharing node pairs have equivalent values of K_4 assigned to them. This model results in the assigning of 46 distinct K-values and is used in the establishment of the initial temperature excess to be used in subsequent iterations. The computed temperature excess variation with location was then used in the calculation of the nodal fin sharing pair R_θ values using Equation (2.26). Once the R_θ values were known, the values of b_2 and b_1 were calculated using Equation (2.30). The assignment of specific, non uniform fin lengths (b_1, b_2) along the tubing surface, required the value of K_4 to be modified for each node. This was required based on the fact that now unique values of $Y_{in,f}$ existed for each node. Applying the K-value equations to each

node, for this model, resulted in the generation of 252 unique values of K_4. These values were then entered into the thermal analysis program. The thermal performance for a variety of flow rates (w_F = 68 kg/hr, 149.7 kg/hr, 272.2 kg/hr, 362.9 kg/hr) was also analyzed for this new model. These analyses provided adequate data for a performance prediction of the TALSR.

V. EFFECTS OF TEMPERATURE EXCESS RATIO VARIATIONS

The base temperature excess (θ_b), as defined earlier, is the difference between the temperature at the base of the fin and the temperature of the coolant fluid, given by;

$$\theta_b = T_b - T_\infty \tag{5.1}$$

It represents the maximum driving potential for convective heat transfer across the fin. Hence, the maximum rate at which a fin could dissipate energy is the rate that would exist if the entire fin surface were at the base temperature. However, because any fin is characterized by a finite conduction resistance, a temperature gradient will exist along the fin and the rate of energy dissipation will be less than the maximum rate. Thus, a convenient measure for the thermal performance of a particular fin is provided by the fin efficiency, η, defined as [Incropera and DeWitt (1981)];

$$\eta = q_f/q_{ideal} \tag{5.2}$$

where

$$q_f = q_b = Y_o\theta_b \tanh(mb_2)$$
$$q_{ideal} = hPb\theta_b \tag{5.3}$$

for a rectangular fin of uniform cross sectional area with an

adiabatic tip. The equation for q_{ideal} represents the heat convectively transferred from a fin of height b to the environment if $\theta = \theta_b$ at all points along the fin. Combining Equations (5.2) and Equation (5.3) results in a conventional fin efficiency given as;

$$\eta = \tanh(mb)/mb \tag{5.4}$$

where m is as given in Equation (2.9), and b is the total height of the fin. The application of this parameter to cold plates with asymmetric heat loading, such as those modeled in the HPX, will result in individual efficiencies being identified for each fin subdivision (b_1 and b_2). In addition, an overall efficiency for the total fin height b is also calculable.

A simplified cold plate configuration will be used as the model for this analysis in order to provide clarity to the development. The model will consist of a single fin with a total height b, and known heat transfer characteristics for the surrounding flow geometry. Therefore, the only required data to complete the thermal analysis of the model is the prime surface temperature on either end of the fin. Once this value is known, R_θ, b_1 and b_2 are easily determined using Equations (2.26) through (2.28).

A conventional derivation of the efficiencies for each fin subdivision is easily determined by substituting the

values of b_1 and b_2 in for the total fin height, b, in Equation (5.3). A conventional overall efficiency of the entire fin height, b, can also be calculated using

$$\eta_{overall} = (q_{actualb1} + q_{actualb2})/(q_{idealb1} + q_{idealb2}) \qquad \textbf{(5.5)}$$

which algebraically reduces to

$$\eta_{overall} = \eta_{b1}/(1 + (b_2/b_1R_\theta)) + \eta_{b2}/(1 + (b_1R_\theta/b_2)) \qquad \textbf{(5.6)}$$

The value of R_θ used in determining Equation (5.6) is based upon the average temperature change across the fin as given by

$$R_\theta = (\Delta T/2 + T_{avg} - T_e)/(-\Delta T/2 + T_{avg} - T_e) \qquad \textbf{(5.7)}$$

where

$$\Delta T = (T_{b1} - T_{b2})$$

and

$$T_{avg} = (T_{b1} + T_{b2})/2 \qquad \textbf{(5.8)}$$

The use of this definition for R_θ, contrary to one based solely on T_{b1} or T_{b2}, provides an accurate representation of the response in fin efficiency due to variations in base temperature excess across the fin.

These variations in fin efficiency were then plotted versus the difference in base temperature excesses as shown in Figure 8.

A more practical definition for fin efficiency would result in the efficiency of each segment increasing with the

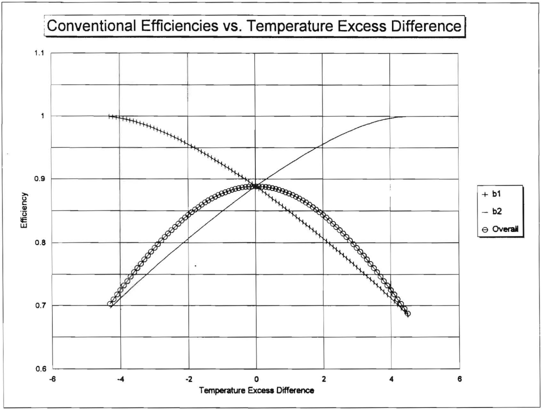


Figure 8: Graphical representation of conventional efficiency variation with changing base temperature excess difference

length of the respective fin heights. For this development the overall efficiency is defined as

$$\eta_{overall} = \eta_1 + \eta_2 \tag{5.9}$$

where η_1 and η_2 are given by

$$\eta_i = q_{fi}/q_{ideal} = Y_o\theta_{bi} \tanh(mb_i)/q_{ideal} \tag{5.10}$$

and i = 1 or 2. The value of q_{ideal} for this development is given as

$$q_{ideal} = hPb\theta_{bi} \tag{5.11}$$

where θ_{bi} is chosen as the maximum value of the magnitude of either θ_{b1} or θ_{b2}. For example, for $R_\theta \geq 1$ it follows from Equation (5.11) that $q_{ideal} = hPb\theta_{b1}$. After substitution of this result into Equation (5.10) and combining with Equation (5.11), it is found that for $R_\theta \geq 1$ overall efficiency is given as

$$\eta_{overall} = (\tanh(mb_1)/(mb)) + (\tanh(mb_2)/(mbR_\theta)) \tag{5.12}$$

Similarly for $R_\theta \leq 1$

$$\eta_{overall} = (R_\theta(\tanh(mb_1))/(mb)) + (\tanh(mb_2)/(mb)) \quad (5.13)$$

These equations are seen to be equal for the case where R_θ = 1. A graphical representation of the relationship between the individual fin efficiencies and the practical overall efficiency is presented in Figure 9.

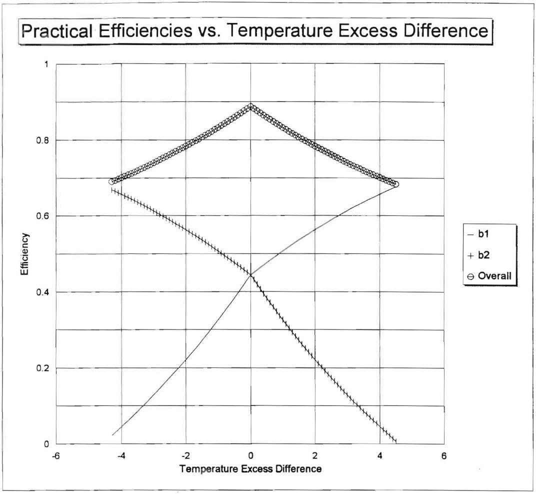


Figure 9 : Relationship of practical efficiencies with variations in base temperature excess difference

VI. RESULTS

An accurate design and performance analysis of the HPX requires critical assessment of the thermal analyzer output data, and representation of that data in a format that is easily understood and interpreted.

A. PROGRAM OUTPUT

The thermal analyzer output data for the simplified model provides baseline temperature excess variations along the surface of the copper tubing and liquid centerline temperatures. The temperature output, for the nodes assigned to the tubing surface (1-144), indicated variations in temperature along the length of the tubing. This is due to variations in available heat transfer area, based on the assignment of node locations and resultant fin allocation. Additionally, the liquid centerline temperature showed a gradually increasing trend from inlet to outlet which is consistent with the expected results.

Analysis of the complex model resulted in similar temperature variations for both the tubing and liquid centerline temperatures, with only slight differences in actual temperature values from those obtained using the simplified model. Complex model analysis for different flow rates indicated that temperature values along the surface of the tube, and throughout the liquid in the tube were largely

dependent on the mass flow rate. For an increasing mass flow rate, this dependence resulted in lower tube surface temperatures, fluid outlet temperature, and overall change in fluid temperature as it passed through the heat exchanger. A summary of the output nodal temperatures for each model considered is found in Appendix E. The results were consistent with expectations and are presented graphically in Figures (10) and (11). In addition, the thermal analysis provided the necessary data to calculate the overall heat transfer for each mass flow rate, using;

$$q = (dm/dt) c_F \Delta T \tag{6.1}$$

where c_F is the specific heat capacity of water (4.182 kJ/kg-K). The heat transfer rate is plotted for each mass flow rate and is presented in Figure (12).

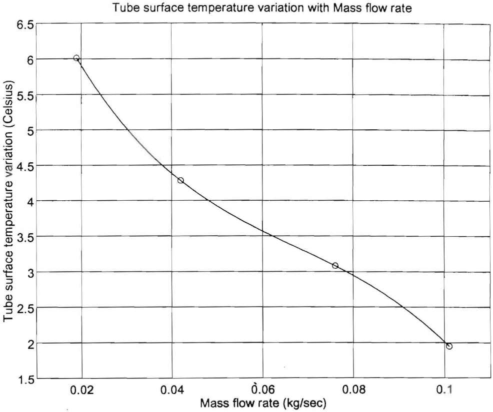


Figure 10: Graphical representation of Tube surface temperature variation with mass flow rate.

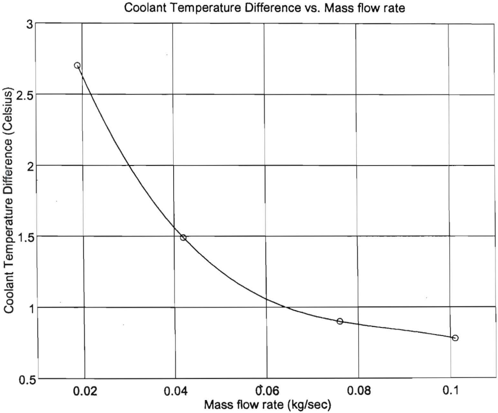


Figure 11: Graphical representation of Coolant Temperature difference ($T_{outlet} - T_{inlet}$) variation with mass flow rate.

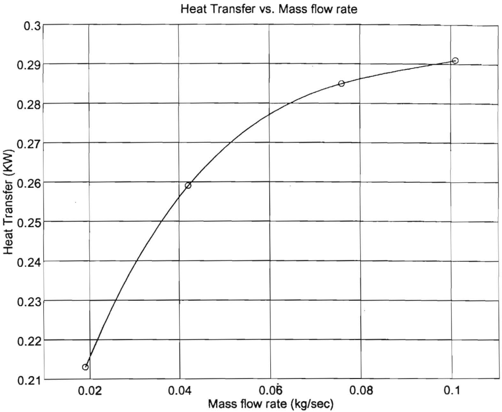


Figure 12: Graphical representation of Heat Transfer with mass flow rate.

VII. SUMMARY AND CONCLUSIONS

The results of this investigation into the thermal performance of the HPX leads to several conclusions. These conclusions are broken down into the following topics: design effectiveness, effectiveness of applying single stack cold plate analysis, effectiveness of computer modeling, and performance analysis validity.

A. DESIGN EFFECTIVENESS

Design effectiveness consideration was based solely on the physical configuration of the HPX. The use of copper tubing bent into a serpentine pattern and then soldered or furnace brazed on a screen of copper fins results in a small and inefficient contact surface between the tubing and the fins. A better design and the one actually used to model the HPX would inlay the copper tubing into the screen of copper fins. This would result in a much higher effective surface area for heat transfer than the current configuration. The success of applying a serpentine tubing pattern for this application as opposed to the more conventional parallel pattern was not analyzed and provides a basis for future thesis work.

B. EFFECTIVENESS OF SINGLE STACK COLD PLATE ANALYSIS

An analysis based on the work of Pieper and Kraus (1995) indicated distinct fin sharing characteristics along the length of copper tubing based on the temperature excess ratio across each shared fin. This resulted in small variations in computed temperatures along the length of the tubing compared to a model subjected to equal operating temperatures on the right and left base surfaces. The magnitude of this variation is dependent on the scale of the application and could result in large values for a large scale application similar to the WyoDak facility in Gillette, Wyoming. Thus, a single stack cold plate analysis would be very useful if the analysis required very accurate representations of temperature along the length of copper tubing in a large scale application. The variation in the magnitude of the temperature variation based on the scale of the application provides a basis for further research.

C. EFFECTIVENESS OF COMPUTER MODELING

Computer modeling provided a convenient and reliable method of calculating the multiple equations created as the result of a detailed analysis of the HPX heat exchanger. The use of computer modeling provides flexibility in the analysis of various heat transfer parameters. The model used for the analysis of the HPX consisted of air flowing over fins,

heating water flowing through the copper tubing. Once these initial inputs are set up and the requisite files built within the thermal analysis software, it becomes simply a matter of replacing the initial model values with new values to evaluate a new system. Therefore, various working fluids with widely varying properties and different internal heat exchanger geometries can be analyzed very easily. This permits the convenient application of specific conditions for a given application, thus saving money and laborious hours in the lab building and evaluating various configurations for a given application. However, once a given application is chosen through the use of computer modeling, extensive testing and empirical data collection is required to validate the computer generated results. For the HPX model analyzed in this thesis, the collection of empirical results through testing and subsequent comparison with the computer generated results is still required.

D. VALIDITY OF PERFORMANCE ANALYSIS

The performance analysis of the HPX required the determination of the convection coefficient, h, and the conductance matrix. These values were determined using numerical analysis techniques.

In the absence of strict correlations for oscillatory flow convection coefficients, a steady flow Nusselt correlation was assumed to provide a suitable representation

of heat transfer in the channel. This is a major assumption, but not without merit based on the argument provided in the thermal performance section. However, a more representative analysis could be made through the application of a Nusselt correlation based solely on acoustically oscillated flow analysis. The derivation of these correlations is currently being pursued through a variety of research, including work conducted at Naval Postgraduate School.

The conductance matrix was used to determine the temperature distribution along the length of the copper tubing. This distribution of temperatures was reasonable and behaved predictably with changes in the mass flow rate of water through the tubing. These temperatures were then used to calculate values for the temperature excess ratio, and subsequently determine the respective lengths of b_1 and b_2. A new temperature distribution was then found based on this cold plate analysis. This provided an adequate representation of the temperature variation along the length of the tubing, however a more accurate distribution could be acquired by repetition of the analysis for each new set of temperature distribution data acquired. This could continue until a user-specified variation limit between successive attempts was met, thus satisfying a predetermined level of accuracy.

APPENDIX A. MURRAY-GARDNER ASSUMPTIONS

The Murray-Gardner assumptions are:

1. The heat flow in the fin and its temperatures remain constant with time.

2. The fin material is homogenous, its thermal conductivity is the same in all directions, and it remains constant.

3. The heat transfer coefficient to the fin is constant and uniform over the entire surface of the fin.

4. The temperature of the medium surrounding the fin is uniform.

5. The fin thickness is so small compared with its height that temperature gradients across the fin thickness may be neglected.

6. The temperature at the base of the fin is uniform.

7. There is no contact resistance where the base of the fin joins the prime surface.

8. There are no heat sources within the fin itself.

9. The heat transferred through the outermost edge of the fin is negligible compared with that leaving the fin through its lateral surface.

10. Heat transfer to or from the fin is proportional to the temperature excess between the fin and the surrounding medium.

APPENDIX B. TRANSFORMATION MATRIX DEVELOPMENT

A general application of linear, homogenous, second-order differential equation theory dictates that Equation (2.7) posses two independent solutions. These solutions, and the subsequent development of a linear transformation matrix to map conditions at the fin tip to conditions at the fin base were performed by Kraus et al. (1978). The solutions, designated $\lambda_1(x)$ and $\lambda_2(x)$, must satisfy the initial conditions at the base of the fin where x = b.

$$\lambda_1(b) = 1;\ \lambda_1'(b) = 0,$$
$$\lambda_2(b) = 0;\ \lambda_2'(b) = (1/kA_c(b)) \qquad \textbf{(B.1)}$$

where the prime indicates a first derivative. The heat flow, q(x), is always taken as positive from base to tip. Therefore, for longitudinal fins, q(x) is given by;

$$q(x) = kA_c(x)(d\theta(x)/dx) \qquad \textbf{(B.2)}$$

Thus, the solutions λ_1 and λ_2 can be used to assemble the expressions for the temperature excess $\theta(x)$ and heat flow q(x), at any point in the fin in terms of θ_b and q_b at the fin base;

$$\theta(x) = \theta_b\lambda_1(x) + q_b\lambda_2(x) \tag{B.3}$$

$$q(x) = kA_c(x)[\theta_b\lambda_1'(x) + q_b\lambda_2'(x)] \tag{B.4}$$

In matrix form, Equations **(B.3)** and **(B.4)** become;

$$\begin{bmatrix}\theta(x)\\ q(x)\end{bmatrix} = \begin{bmatrix}1 & 0\\ 0 & kA_c(x)\end{bmatrix} \begin{bmatrix}\lambda_1(x) & \lambda_2(x)\\ \lambda_1'(x) & \lambda_2'(x)\end{bmatrix} \begin{bmatrix}\theta_b\\ q_b\end{bmatrix} \tag{B.5}$$

The thermal transmission matrix is the linear transformation generated when x is set equal to a, where a equals either the fin height or zero depending on the origin of the height coordinate;

$$\begin{bmatrix}\theta_a\\ q_a\end{bmatrix} = \Gamma\begin{bmatrix}\theta_b\\ q_b\end{bmatrix} = \begin{bmatrix}\gamma_{11} & \gamma_{12}\\ \gamma_{21} & \gamma_{22}\end{bmatrix} \begin{bmatrix}\theta_b\\ q_b\end{bmatrix} \tag{B.6}$$

where

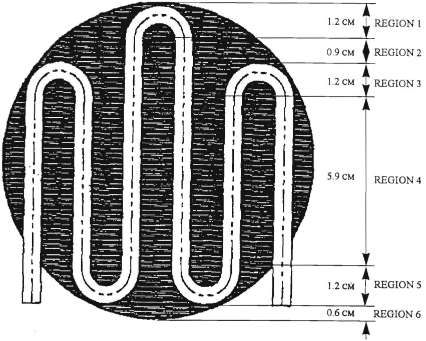
$$\gamma_{11} = \lambda_1(a)$$
$$\gamma_{12} = \lambda_2(a)$$
$$\gamma_{21} = kA_c(a)\lambda_1'(a)$$
$$\gamma_{22} = kA_c(a)\lambda_2'(a) \tag{B.7}$$

The elements of the thermal transmission matrix are called the thermal transmission parameters. To represent conditions at the fin base in terms of conditions at the fin tip, it is seen that;

$$\begin{bmatrix} \theta_b \\ q_b \end{bmatrix} = \Gamma^{-1} \begin{bmatrix} \theta_a \\ q_a \end{bmatrix} = \beta \begin{bmatrix} \theta_a \\ q_a \end{bmatrix} = \begin{bmatrix} \tau_{11} & \tau_{12} \\ \tau_{21} & \tau_{22} \end{bmatrix} \begin{bmatrix} \theta_a \\ q_a \end{bmatrix} \qquad \textbf{(B.8)}$$

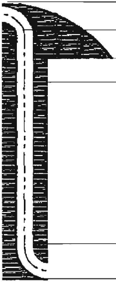
where the matrix β is the inverse of the thermal transmission matrix and is called the inverse thermal transmission matrix. Its elements are designated as the inverse thermal transmission parameters.

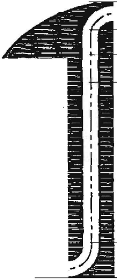
APPENDIX C. NODAL MODELING DATA



REGION	LENGTH (CM)	# OF FINS	# OF NODES	FINS/NODE
1	1.2	22.6	3	7.53
2	0.9	16.2	2	8.1
3	1.2	22.6	3	7.53
4	5.9	110.7	16	6.92
5	1.2	22.6	3	7.53
6	0.6	11.3	0	N/A

Tube Surface Nodes	Liquid Nodes
21 - 23	165 - 167
5 - 20	149 - 164
1 - 4	145 - 148
24 - 26	168 - 170
27 - 42	171 - 186
43 - 45	187 - 189





Tube Surface Nodes	Liquid Nodes
70 - 72	214 - 216
68 - 69	212 - 213
65 - 67	209 - 211
49 - 64	193 - 208
46 - 48	190 - 192
73 - 75	217 - 219
76 - 77	220 - 221
78 - 80	222 - 220
81 - 96	223 - 238
97 - 99	239 - 242

Tube Surface Nodes	Liquid Nodes
119 -121	263 - 265
103 - 118	247 - 262
100 - 102	244 - 246
122 - 124	266 - 268
125 - 140	269 - 284
141 - 144	284 - 288

APPENDIX D. SPREADSHEET K-VALUE DETERMINATION AND NODE CONNECTION DATA

The general procedure for each case is as follows:

1. Use node location and applicable equations to determine fin length associated with that particular node.

2. Determine K-Values using spreadsheet application.

3. Input K-Values into user friendly spreadsheet that associates each K-Value with a particular node and branch.

4. Once K-Values are input into thermal analysis software, an easily read summary of the individual branches and their associated conductances is produced.

TASS GENERAL INPUT MENU - SI Units

(1) Case Title:
TALSR(METRIC)---- RUN 1. SIMPLE MODEL CASE

(2) Nodes	288
(3) Constant Temperatures	2
(4) Unique Exponents	0
(5) Temperature Dependent Conductances	0
(6) Temperature Dependent Heat Inputs	0
(7) Computational Accuracy	.0100
(8) Starting Temperature	25.0

Are these inputs correct (Y/N) ? Y

CONDUCTIVITY	EFFECTIVE FIN LENGTH (L) IN CENTIMETERS
K1	N/A
K2	N/A
K3	N/A
K4	N/A
K5	N/A
K6	0.5715
K7	0.094
K8	0.269
K9	0.414
K10	0.531
K11	0.62
K12	0.681
K13	0.716
K14	0.732
K15	N/A
K16	N/A
K17	N/A
K18	0.552
K19	0.404
K20	0.148
K21	1.0185
K22	0.748
K23	0.592
K24	0.888
K25	0.55
K26	1.4655
K27	0.925
K28	0.6125
K29	N/A
K30	N/A
K31	N/A
K32	0.5715
K33	N/A
K34	N/A
K35	N/A
K36	N/A
K37	N/A
K38	N/A
K39	0.5715
K40	2.907
K41	N/A
K42	2.482
K43	1.84
K44	1.119
K45	0.359
K46	N/A

TACSEM

INPUT DATA

Fin Length (L) (cm)	Fin Thickness (cm)	Fin spacing (z) (cm)	Thermal Conductivity of Copper (k) (W/m-K)	Reynolds Number	Prandtl Number	Outer pipe diameter (cm)	Inner pipe diameter (cm)	Pipe Area (sq. cm.)
0.318	0.015	0.053	401.00	1900.00	0.707	0.635	0.483	0.134

Item	Channel Width (b) (cm)	Effective Diameter (cm)	Heat Transfer Coefficent (h) (W/sqcm-K)	Yin,f (W/K)	Dist. between Nodes (cm)	Fins/node	K - Value (W/K)
K1			N/A		0.302	N/A	1.778
K2			1.260		0.302	N/A	0.576
K3			N/A		0.334	N/A	1.604
K4			N/A		0.367	N/A	1.461
K5			1.260		0.367	N/A	0.701
K6	1.143	0.10192	0.03626	0.01169	0.367	6.880	0.084
K7	0.094	0.06805	0.04746	0.00282	0.367	6.880	0.024
K8	0.269	0.08904	0.03967	0.00658	0.367	6.880	0.049
K9	0.414	0.09450	0.03813	0.00937	0.367	6.880	0.068
K10	0.531	0.09694	0.03749	0.01136	0.367	6.880	0.082
K11	0.620	0.09823	0.03716	0.01271	0.367	6.880	0.091
K12	0.681	0.09893	0.03698	0.01354	0.367	6.880	0.097
K13	0.716	0.09929	0.03690	0.01400	0.367	6.880	0.100
K14	0.732	0.09943	0.03686	0.01419	0.367	6.880	0.101
K15			N/A		0.416	N/A	1.291
K16			N/A		0.465	N/A	1.152
K17			1.260		0.465	N/A	0.889
K18	1.104	0.10176	0.03629	0.01138	0.465	7.540	0.090
K19	0.808	0.10008	0.03670	0.00885	0.465	7.540	0.071
K20	0.296	0.09038	0.03928	0.00366	0.465	7.540	0.032
K21	2.037	0.10396	0.03578	0.01683	0.465	7.540	0.131
K22	1.496	0.10301	0.03600	0.01413	0.465	7.540	0.111
K23	1.184	0.10208	0.03622	0.01200	0.465	7.540	0.094
K24	0.888	0.10064	0.03657	0.01591	0.465	7.540	0.124
K25	0.550	0.09725	0.03741	0.01167	0.465	7.540	0.092
K26	2.931	0.10477	0.03560	0.01924	0.465	7.540	0.149
K27	1.850	0.10369	0.03584	0.01602	0.465	7.540	0.125
K28	1.225	0.10223	0.03618	0.01230	0.465	7.540	0.097
K29			N/A		0.496	N/A	1.082
K30			N/A		0.541	N/A	0.992
K31			1.260		0.518	N/A	0.990
K32	1.143	0.10192	0.03626	0.01169	0.541	7.540	0.092
K33			N/A		0.312	N/A	1.717
K34			1.260		0.427	N/A	0.815

K35			N/A		0.255	N/A	2.100
K36			1.260		0.284	N/A	0.542
K37			N/A		0.429	N/A	1.251
K38			1.260		0.343	N/A	0.655
K39	1.143	0.10192	0.03626	0.01169	0.429	8.040	0.098
K40	2.907	0.10476	0.03560	0.02086	0.429	8.040	0.172
K41			N/A		0.447	N/A	1.200
K42	2.482	0.10444	0.03567	0.02077	0.429	8.040	0.171
K43	1.840	0.10368	0.03585	0.02025	0.465	7.540	0.157
K44	1.119	0.10182	0.03628	0.01775	0.465	7.540	0.138
K45	0.359	0.09288	0.03857	0.00834	0.465	7.540	0.067
K46							173.886

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S,
1	1	2	1	K1	51	16	17	1	S9
2		145	4	K2	52		160	4	S10
3	2	3	1	S1	53		301	1	S11
4		146	4	S2	54		301	1	S38
5	3	4	1	S1	55	17	18	1	S9
6		147	4	S2	56		161	4	S10
7	4	5	1	K3	57		301	1	S11
8		148	4	S2	58		301	1	S34
9	5	6	1	K4	59	18	19	1	S9
10		149	4	K5	60		162	4	S10
11		301	1	K6	61		301	1	S11
12	6	7	1	S9	62		301	1	S30
13		150	4	S10	63	19	20	1	S9
14		301	1	S11	64		163	4	S10
15	7	8	1	S9	65		301	1	S11
16		151	4	S10	66		301	1	S26
17		301	1	S11	67	20	21	1	K15
18		301	1	K7	68		164	4	S10
19	8	9	1	S9	69		301	1	S11
20		152	4	S10	70		301	1	S22
21		301	1	S11	71	21	22	1	K16
22		301	1	K8	72		165	4	K17
23	9	10	1	S9	73		301	1	K18
24		153	4	S10	74	22	23	1	S71
25		301	1	S11	75		166	4	S72
26		301	1	K9	76		301	1	K19
27	10	11	1	S9	77	23	24	1	S71
28		154	4	S10	78		167	4	S72
29		301	1	S11	79		301	1	K20
30		301	1	K10	80	24	25	1	S71
31	11	12	1	S9	81		168	4	S72
32		155	4	S10	82		301	1	K21
33		301	1	S11	83		301	1	S79
34		301	1	K11	84	25	26	1	S71
35	12	13	1	S9	85		169	4	S72
36		156	4	S10	86		301	1	K22
37		301	1	S11	87		301	1	S76
38		301	1	K12	88	26	27	1	S67
39	13	14	1	S9	89		170	4	S72
40		157	4	S10	90		301	1	K23
41		301	1	S11	91		301	1	S73
42		301	1	K13	92	27	28	1	S9
43	14	15	1	S9	93		171	4	S10
44		158	4	S10	94		301	1	S11
45		301	1	S11	95		301	1	S11
46		301	1	K14	96	28	29	1	S9
47	15	16	1	S9	97		172	4	S10
48		159	4	S10	98		301	1	S11
49		301	1	S11	99		301	1	S11
50		301	1	S42	100	29	30	1	S9

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S.
101		173	4	S10	151		301	1	S11
102		301	1	S11	152	42	43	1	S67
103		301	1	S11	153		186	4	S10
104	30	31	1	S9	154		301	1	S11
105		174	4	S10	155		301	1	S11
106		301	1	S11	156	43	44	1	S71
107		301	1	S11	157		187	4	S72
108	31	32	1	S9	158		301	1	S73
109		175	4	S10	159		301	1	K24
110		301	1	S11	160	44	45	1	S71
111		301	1	S11	161		188	4	S72
112	32	33	1	S9	162		301	1	S76
113		176	4	S10	163		301	1	K25
114		301	1	S11	164	45	46	1	S71
115		301	1	S11	165		189	4	S72
116	33	34	1	S9	166		301	1	S79
117		177	4	S10	167	46	47	1	S71
118		301	1	S11	168		190	4	S72
119		301	1	S11	169		301	1	K26
120	34	35	1	S9	170		301	1	S79
121		178	4	S10	171	47	48	1	S71
122		301	1	S11	172		191	4	S72
123		301	1	S11	173		301	1	K27
124	35	36	1	S9	174		301	1	S76
125		179	4	S10	175	48	49	1	S67
126		301	1	S11	176		192	4	S72
127		301	1	S11	177		301	1	K28
128	36	37	1	S9	178		301	1	S73
129		180	4	S10	179	49	50	1	S9
130		301	1	S11	180		193	4	S10
131		301	1	S11	181		301	1	S11
132	37	38	1	S9	182		301	1	S11
133		181	4	S10	183	50	51	1	S9
134		301	1	S11	184		194	4	S10
135		301	1	S11	185		301	1	S11
136	38	39	1	S9	186		301	1	S11
137		182	4	S10	187	51	52	1	S9
138		301	1	S11	188		195	4	S10
139		301	1	S11	189		301	1	S11
140	39	40	1	S9	190		301	1	S11
141		183	4	S10	191	52	53	1	S9
142		301	1	S11	192		196	4	S10
143		301	1	S11	193		301	1	S11
144	40	41	1	S9	194		301	1	S11
145		184	4	S10	195	53	54	1	S9
146		301	1	S11	196		197	4	S10
147		301	1	S11	197		301	1	S11
148	41	42	1	S9	198		301	1	S11
149		185	4	S10	199	54	55	1	S9
150		301	1	S11	200		198	4	S10

BRANCH	NODE	TON	TAG	I. C. S	BRANCH	NODE	TON	TAG	I. C. S
201		301	1	S11	251	67	68	1	K35
202		301	1	S11	252		211	4	K36
203	55	56	1	S9	253		301	1	S245
204		199	4	S10	254		301	1	S82
205		301	1	S11	255	68	69	1	K37
206		301	1	S11	256		212	4	K38
207	56	57	1	S9	257		301	1	K39
208		200	4	S10	258		301	1	K40
209		301	1	S11	259	69	70	1	K41
210		301	1	S11	260		213	4	S256
211	57	58	1	S9	261		301	1	S257
212		201	4	S10	262		301	1	K42
213		301	1	S11	263	70	71	1	S71
214		301	1	S11	264		214	4	S72
215	58	59	1	S9	265		301	1	S73
216		202	4	S10	266		301	1	K43
217		301	1	S11	267	71	72	1	S71
218		301	1	S11	268		215	4	S72
219	59	60	1	S9	269		301	1	S76
220		203	4	S10	270		301	1	K44
221		301	1	S11	271	72	73	1	S71
222		301	1	S11	272		216	4	S72
223	60	61	1	S9	273		301	1	S79
224		204	4	S10	274		301	1	K45
225		301	1	S11	275	73	74	1	S71
226		301	1	S11	276		217	4	S72
227	61	62	1	S9	277		301	1	S274
228		205	4	S10	278		301	1	S79
229		301	1	S11	279	74	75	1	S71
230		301	1	S11	280		218	4	S72
231	62	63	1	S9	281		301	1	S270
232		206	4	S10	282		301	1	S76
233		301	1	S11	283	75	76	1	S259
234		301	1	S11	284		219	4	S72
235	63	64	1	S9	285		301	1	S266
236		207	4	S10	286		301	1	S73
237		301	1	S11	287	76	77	1	S255
238		301	1	S11	288		220	4	S256
239	64	65	1	K29	289		301	1	S262
240		208	4	S10	290		301	1	S257
241		301	1	S11	291	77	78	1	S251
242		301	1	S11	292		221	4	S256
243	65	66	1	K30	293		301	1	S258
244		209	4	K31	294		301	1	S257
245		301	1	K32	295	78	79	1	S247
246		301	1	S90	296		222	4	S252
247	66	67	1	K33	297		301	1	S82
248		210	4	K34	298		301	1	S245
249		301	1	S245	299	79	80	1	S243
250		301	1	S86	300		223	4	S248

BRANCH	NODE	TON	TAG	I. C. S	BRANCH	NODE	TON	TAG	I. C. S
301		301	1	S86	352		236	4	S10
302		301	1	S245	353		301	1	S11
303	80	81	1	S239	354		301	1	S11
304		224	4	S244	355	93	94	1	S9
305		301	1	S90	356		237	4	S10
306		301	1	S245	357		301	1	S11
307	81	82	1	S9	358		301	1	S11
308		225	4	S10	359	94	95	1	S9
309		301	1	S11	360		238	4	S10
310		301	1	S11	361		301	1	S11
311	82	83	1	S9	362		301	1	S11
312		226	4	S10	363	95	96	1	S9
313		301	1	S11	364		239	4	S10
314		301	1	S11	365		301	1	S11
315	83	84	1	S9	366		301	1	S11
316		227	4	S10	367	96	97	1	S67
317		301	1	S11	368		240	4	S10
318		301	1	S11	369		301	1	S11
319	84	85	1	S9	370		301	1	S11
320		228	4	S10	371	97	98	1	S71
321		301	1	S11	372		241	4	S72
322		301	1	S11	373		301	1	S73
323	85	86	1	S9	374		301	1	S177
324		229	4	S10	375	98	99	1	S71
325		301	1	S11	376		242	4	S72
326		301	1	S11	377		301	1	S76
327	86	87	1	S9	378		301	1	S173
328		230	4	S10	379	99	100	1	S71
329		301	1	S11	380		243	4	S72
330		301	1	S11	381		301	1	S79
331	87	88	1	S9	382		301	1	S169
332		231	4	S10	383	100	101	1	S71
333		301	1	S11	384		244	4	S72
334		301	1	S11	385		301	1	S79
335	88	89	1	S9	386	101	102	1	S71
336		232	4	S10	387		245	4	S72
337		301	1	S11	388		301	1	S163
338		301	1	S11	389		301	1	S76
339	89	90	1	S9	390	102	103	1	S67
340		233	4	S10	391		246	4	S72
341		301	1	S11	392		301	1	S159
342		301	1	S11	393		301	1	S73
343	90	91	1	S9	394	103	104	1	S9
344		234	4	S10	395		247	4	S10
345		301	1	S11	396		301	1	S11
346		301	1	S11	397		301	1	S11
347	91	92	1	S9	398	104	105	1	S9
348		235	4	S10	399		248	4	S10
349		301	1	S11	400		301	1	S11
350		301	1	S11	401		301	1	S11
351	92	93	1	S9	402	105	106	1	S9

BRANCH	NODE	TON	TAG	I. C. S	BRANCH	NODE	TON	TAG	I. C. S
403		249	4	S10	453		301	1	S11
404		301	1	S11	454	118	119	1	S67
405		301	1	S11	455		262	4	S10
406	106	107	1	S9	456		301	1	S11
407		250	4	S10	457		301	1	S11
408		301	1	S11	458	119	120	1	S71
409		301	1	S11	459		263	4	S72
410	107	108	1	S9	460		301	1	S73
411		251	4	S10	461		301	1	S90
412		301	1	S11	462	120	121	1	S71
413		301	1	S11	463		264	4	S72
414	108	109	1	S9	464		301	1	S76
415		252	4	S10	465		301	1	S86
416		301	1	S11	466	121	122	1	S71
417		301	1	S11	467		265	4	S72
418	109	110	1	S9	468		301	1	S79
419		253	4	S10	469		301	1	S82
420		301	1	S11	470	122	123	1	S71
421		301	1	S11	471		266	4	S72
422	110	111	1	S9	472		301	1	S79
423		254	4	S10	473	123	124	1	S71
424		301	1	S11	474		267	4	S72
425		301	1	S11	475		301	1	S76
426	111	112	1	S9	476	124	125	1	S67
427		255	4	S10	477		268	4	S72
428		301	1	S11	478		301	1	S73
429		301	1	S11	479	125	126	1	S9
430	112	113	1	S9	480		269	4	S10
431		256	4	S10	481		301	1	S22
432		301	1	S11	482		301	1	S11
433		301	1	S11	483	126	127	1	S9
434	113	114	1	S9	484		270	4	S10
435		257	4	S10	485		301	1	S26
436		301	1	S11	486		301	1	S11
437		301	1	S11	487	127	128	1	S9
438	114	115	1	S9	488		271	4	S10
439		258	4	S10	489		301	1	S30
440		301	1	S11	490		301	1	S11
441		301	1	S11	491	128	129	1	S9
442	115	116	1	S9	492		272	4	S10
443		259	4	S10	493		301	1	S34
444		301	1	S11	494		301	1	S11
445		301	1	S11	495	129	130	1	S9
446	116	117	1	S9	496		273	4	S10
447		260	4	S10	497		301	1	S38
448		301	1	S11	498		301	1	S11
449		301	1	S11	499	130	131	1	S9
450	117	118	1	S9	500		274	4	S10
451		261	4	S10	501		301	1	S42
452		301	1	S11	502		301	1	S11

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S
503	131	132	1	S9	553				
504		275	4	S10	554				
505		301	1	S46	555				
506		301	1	S11	556				
507	132	133	1	S9	557				
508		276	4	S10	558				
509		301	1	S42	559				
510		301	1	S11	560				
511	133	134	1	S9	561				
512		277	4	S10	562				
513		301	1	S38	563				
514		301	1	S11	564				
515	134	135	1	S9	565				
516		278	4	S10	566				
517		301	1	S34	567				
518		301	1	S11	568				
519	135	136	1	S9	569				
520		279	4	S10	570				
521		301	1	S30	571				
522		301	1	S11	572				
523	136	137	1	S9	573				
524		280	4	S10	574				
525		301	1	S26	575				
526		301	1	S11	576				
527	137	138	1	S9	577				
528		281	4	S10	578				
529		301	1	S22	579				
530		301	1	S11	580				
531	138	139	1	S9	581				
532		282	4	S10	582				
533		301	1	S18	583				
534		301	1	S11	584				
535	139	140	1	S9	585				
536		283	4	S10	586				
537		301	1	S11	587				
538	140	141	1	S7	588				
539		284	4	S10	589				
540		301	1	S11	590				
541	141	142	1	S1	591				
542		285	4	S2	592				
543	142	143	1	S1	593				
544		286	4	S2	594				
545	143	144	1	S1	595				
546		287	4	S2	596				
547	144	288	4	S2	597				
548					598				
549					599				
550					600				
551					601				
552					602				

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S,
701	145	302	5	K46	751	195	194	5	S701
702	146	145	5	S701	752	196	195	5	S701
703	147	146	5	S701	753	197	196	5	S701
704	148	147	5	S701	754	198	197	5	S701
705	149	148	5	S701	755	199	198	5	S701
706	150	149	5	S701	756	200	199	5	S701
707	151	150	5	S701	757	201	200	5	S701
708	152	151	5	S701	758	202	201	5	S701
709	153	152	5	S701	759	203	202	5	S701
710	154	153	5	S701	760	204	203	5	S701
711	155	154	5	S701	761	205	204	5	S701
712	156	155	5	S701	762	206	205	5	S701
713	157	156	5	S701	763	207	206	5	S701
714	158	157	5	S701	764	208	207	5	S701
715	159	158	5	S701	765	209	208	5	S701
716	160	159	5	S701	766	210	209	5	S701
717	161	160	5	S701	767	211	210	5	S701
718	162	161	5	S701	768	212	211	5	S701
719	163	162	5	S701	769	213	212	5	S701
720	164	163	5	S701	770	214	213	5	S701
721	165	164	5	S701	771	215	214	5	S701
722	166	165	5	S701	772	216	215	5	S701
723	167	166	5	S701	773	217	216	5	S701
724	168	167	5	S701	774	218	217	5	S701
725	169	168	5	S701	775	219	218	5	S701
726	170	169	5	S701	776	220	219	5	S701
727	171	170	5	S701	777	221	220	5	S701
728	172	171	5	S701	778	222	221	5	S701
729	173	172	5	S701	779	223	222	5	S701
730	174	173	5	S701	780	224	223	5	S701
731	175	174	5	S701	781	225	224	5	S701
732	176	175	5	S701	782	226	225	5	S701
733	177	176	5	S701	783	227	226	5	S701
734	178	177	5	S701	784	228	227	5	S701
735	179	178	5	S701	785	229	228	5	S701
736	180	179	5	S701	786	230	229	5	S701
737	181	180	5	S701	787	231	230	5	S701
738	182	181	5	S701	788	232	231	5	S701
739	183	182	5	S701	789	233	232	5	S701
740	184	183	5	S701	790	234	233	5	S701
741	185	184	5	S701	791	235	234	5	S701
742	186	185	5	S701	792	236	235	5	S701
743	187	186	5	S701	793	237	236	5	S701
744	188	187	5	S701	794	238	237	5	S701
745	189	188	5	S701	795	239	238	5	S701
746	190	189	5	S701	796	240	239	5	S701
747	191	190	5	S701	797	241	240	5	S701
748	192	191	5	S701	798	242	241	5	S701
749	193	192	5	S701	799	243	242	5	S701
750	194	193	5	S701	800	244	243	5	S701

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S.
801	245	244	5	S701	851				
802	246	245	5	S701	852				
803	247	246	5	S701	853				
804	248	247	5	S701	854				
805	249	248	5	S701	855				
806	250	249	5	S701	856				
807	251	250	5	S701	857				
808	252	251	5	S701	858				
809	253	252	5	S701	859				
810	254	253	5	S701	860				
811	255	254	5	S701	861				
812	256	255	5	S701	862				
813	257	256	5	S701	863				
814	258	257	5	S701	864				
815	259	258	5	S701	865				
816	260	259	5	S701	866				
817	261	260	5	S701	867				
818	262	261	5	S701	868				
819	263	262	5	S701	869				
820	264	263	5	S701	870				
821	265	264	5	S701	871				
822	266	265	5	S701	872				
823	267	266	5	S701	873				
824	268	267	5	S701	874				
825	269	268	5	S701	875				
826	270	269	5	S701	876				
827	271	270	5	S701	877				
828	272	271	5	S701	878				
829	273	272	5	S701	879				
830	274	273	5	S701	880				
831	275	274	5	S701	881				
832	276	275	5	S701	882				
833	277	276	5	S701	883				
834	278	277	5	S701	884				
835	279	278	5	S701	885				
836	280	279	5	S701	886				
837	281	280	5	S701	887				
838	282	281	5	S701	888				
839	283	282	5	S701	889				
840	284	283	5	S701	890				
841	285	284	5	S701	891				
842	286	285	5	S701	892				
843	287	286	5	S701	893				
844	288	287	5	S701	894				
845					895				
846					896				
847					897				
848					898				
849					899				
850					900				

TASS Branch Connection Summary in W/degC or Watts if Tag = 10

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
1	1	2	1	.178E+01	57	17	301	1	.840E-01	113	32	176	4	.701E+00
2	1	145	4	.576E+00	58	17	301	1	.910E-01	114	32	301	1	.840E-01
3	2	3	1	.178E+01	59	18	19	1	.146E+01	115	32	301	1	.840E-01
4	2	146	4	.576E+00	60	18	162	4	.701E+00	116	33	34	1	.146E+01
5	3	4	1	.178E+01	61	18	301	1	.840E-01	117	33	177	4	.701E+00
6	3	147	4	.576E+00	62	18	301	1	.820E-01	118	33	301	1	.840E-01
7	4	5	1	.160E+01	63	19	20	1	.146E+01	119	33	301	1	.840E-01
8	4	148	4	.576E+00	64	19	163	4	.701E+00	120	34	35	1	.146E+01
9	5	6	1	.146E+01	65	19	301	1	.840E-01	121	34	178	4	.701E+00
10	5	149	4	.701E+00	66	19	301	1	.680E-01	122	34	301	1	.840E-01
11	5	301	1	.840E-01	67	20	21	1	.129E+01	123	34	301	1	.840E-01
12	6	7	1	.146E+01	68	20	164	4	.701E+00	124	35	36	1	.146E+01
13	6	150	4	.701E+00	69	20	301	1	.840E-01	125	35	179	4	.701E+00
14	6	301	1	.840E-01	70	20	301	1	.490E-01	126	35	301	1	.840E-01
15	7	8	1	.146E+01	71	21	22	1	.115E+01	127	35	301	1	.840E-01
16	7	151	4	.701E+00	72	21	165	4	.889E+00	128	36	37	1	.146E+01
17	7	301	1	.840E-01	73	21	301	1	.900E-01	129	36	180	4	.701E+00
18	7	301	1	.240E-01	74	22	23	1	.115E+01	130	36	301	1	.840E-01
19	8	9	1	.146E+01	75	22	166	4	.889E+00	131	36	301	1	.840E-01
20	8	152	4	.701E+00	76	22	301	1	.710E-01	132	37	38	1	.146E+01
21	8	301	1	.840E-01	77	23	24	1	.115E+01	133	37	181	4	.701E+00
22	8	301	1	.490E-01	78	23	167	4	.889E+00	134	37	301	1	.840E-01
23	9	10	1	.146E+01	79	23	301	1	.320E-01	135	37	301	1	.840E-01
24	9	153	4	.701E+00	80	24	25	1	.115E+01	136	38	39	1	.146E+01
25	9	301	1	.840E-01	81	24	168	4	.889E+00	137	38	182	4	.701E+00
26	9	301	1	.680E-01	82	24	301	1	.131E+00	138	38	301	1	.840E-01
27	10	11	1	.146E+01	83	24	301	1	.320E-01	139	38	301	1	.840E-01
28	10	154	4	.701E+00	84	25	26	1	.115E+01	140	39	40	1	.146E+01
29	10	301	1	.840E-01	85	25	169	4	.889E+00	141	39	183	4	.701E+00
30	10	301	1	.820E-01	86	25	301	1	.111E+00	142	39	301	1	.840E-01
31	11	12	1	.146E+01	87	25	301	1	.710E-01	143	39	301	1	.840E-01
32	11	155	4	.701E+00	88	26	27	1	.129E+01	144	40	41	1	.146E+01
33	11	301	1	.840E-01	89	26	170	4	.889E+00	145	40	184	4	.701E+00
34	11	301	1	.910E-01	90	26	301	1	.940E-01	146	40	301	1	.840E-01
35	12	13	1	.146E+01	91	26	301	1	.900E-01	147	40	301	1	.840E-01
36	12	156	4	.701E+00	92	27	28	1	.146E+01	148	41	42	1	.146E+01
37	12	301	1	.840E-01	93	27	171	4	.701E+00	149	41	185	4	.701E+00
38	12	301	1	.970E-01	94	27	301	1	.840E-01	150	41	301	1	.840E-01
39	13	14	1	.146E+01	95	27	301	1	.840E-01	151	41	301	1	.840E-01
40	13	157	4	.701E+00	96	28	29	1	.146E+01	152	42	43	1	.129E+01
41	13	301	1	.840E-01	97	28	172	4	.701E+00	153	42	186	4	.701E+00
42	13	301	1	.100E+00	98	28	301	1	.840E-01	154	42	301	1	.840E-01
43	14	15	1	.146E+01	99	28	301	1	.840E-01	155	42	301	1	.840E-01
44	14	158	4	.701E+00	100	29	30	1	.146E+01	156	43	44	1	.115E+01
45	14	301	1	.840E-01	101	29	173	4	.701E+00	157	43	187	4	.889E+00
46	14	301	1	.101E+00	102	29	301	1	.840E-01	158	43	301	1	.900E-01
47	15	16	1	.146E+01	103	29	301	1	.840E-01	159	43	301	1	.124E+00
48	15	159	4	.701E+00	104	30	31	1	.146E+01	160	44	45	1	.115E+01
49	15	301	1	.840E-01	105	30	174	4	.701E+00	161	44	188	4	.889E+00
50	15	301	1	.100E+00	106	30	301	1	.840E-01	162	44	301	1	.710E-01
51	16	17	1	.146E+01	107	30	301	1	.840E-01	163	44	301	1	.920E-01
52	16	160	4	.701E+00	108	31	32	1	.146E+01	164	45	46	1	.115E+01
53	16	301	1	.840E-01	109	31	175	4	.701E+00	165	45	189	4	.889E+00
54	16	301	1	.970E-01	110	31	301	1	.840E-01	166	45	301	1	.320E-01
55	17	18	1	.146E+01	111	31	301	1	.840E-01	167	46	47	1	.115E+01
56	17	161	4	.701E+00	112	32	33	1	.146E+01	168	46	190	4	.889E+00

Brnh	From	To	Tag	Conduct
169	46	301	1	.149E+00
170	46	301	1	.320E-01
171	47	48	1	.115E+01
172	47	191	4	.889E+00
173	47	301	1	.125E+00
174	47	301	1	.710E-01
175	48	49	1	.129E+01
176	48	192	4	.889E+00
177	48	301	1	.970E-01
178	48	301	1	.900E-01
179	49	50	1	.146E+01
180	49	193	4	.701E+00
181	49	301	1	.840E-01
182	49	301	1	.840E-01
183	50	51	1	.146E+01
184	50	194	4	.701E+00
185	50	301	1	.840E-01
186	50	301	1	.840E-01
187	51	52	1	.146E+01
188	51	195	4	.701E+00
189	51	301	1	.840E-01
190	51	301	1	.840E-01
191	52	53	1	.146E+01
192	52	196	4	.701E+00
193	52	301	1	.840E-01
194	52	301	1	.840E-01
195	53	54	1	.146E+01
196	53	197	4	.701E+00
197	53	301	1	.840E-01
198	53	301	1	.840E-01
199	54	55	1	.146E+01
200	54	198	4	.701E+00
201	54	301	1	.840E-01
202	54	301	1	.840E-01
203	55	56	1	.146E+01
204	55	199	4	.701E+00
205	55	301	1	.840E-01
206	55	301	1	.840E-01
207	56	57	1	.146E+01
208	56	200	4	.701E+00
209	56	301	1	.840E-01
210	56	301	1	.840E-01
211	57	58	1	.146E+01
212	57	201	4	.701E+00
213	57	301	1	.840E-01
214	57	301	1	.840E-01
215	58	59	1	.146E+01
216	58	202	4	.701E+00
217	58	301	1	.840E-01
218	58	301	1	.840E-01
219	59	60	1	.146E+01
220	59	203	4	.701E+00
221	59	301	1	.840E-01
222	59	301	1	.840E-01
223	60	61	1	.146E+01
224	60	204	4	.701E+00
225	60	301	1	.840E-01
226	60	301	1	.840E-01
227	61	62	1	.146E+01
228	61	205	4	.701E+00
229	61	301	1	.840E-01
230	61	301	1	.840E-01
231	62	63	1	.146E+01
232	62	206	4	.701E+00
233	62	301	1	.840E-01
234	62	301	1	.840E-01
235	63	64	1	.146E+01
236	63	207	4	.701E+00
237	63	301	1	.840E-01
238	63	301	1	.840E-01
239	64	65	1	.108E+01
240	64	208	4	.701E+00
241	64	301	1	.840E-01
242	64	301	1	.840E-01
243	65	66	1	.992E+00
244	65	209	4	.990E+00
245	65	301	1	.920E-01
246	65	301	1	.940E-01
247	66	67	1	.172E+01
248	66	210	4	.815E+00
249	66	301	1	.920E-01
250	66	301	1	.111E+00
251	67	68	1	.210E+01
252	67	211	4	.542E+00
253	67	301	1	.920E-01
254	67	301	1	.131E+00
255	68	69	1	.125E+01
256	68	212	4	.655E+00
257	68	301	1	.980E-01
258	68	301	1	.172E+00
259	69	70	1	.120E+01
260	69	213	4	.655E+00
261	69	301	1	.980E-01
262	69	301	1	.171E+00
263	70	71	1	.115E+01
264	70	214	4	.889E+00
265	70	301	1	.900E-01
266	70	301	1	.157E+00
267	71	72	1	.115E+01
268	71	215	4	.889E+00
269	71	301	1	.710E-01
270	71	301	1	.138E+00
271	72	73	1	.115E+01
272	72	216	4	.889E+00
273	72	301	1	.320E-01
274	72	301	1	.670E-01
275	73	74	1	.115E+01
276	73	217	4	.889E+00
277	73	301	1	.670E-01
278	73	301	1	.320E-01
279	74	75	1	.115E+01
280	74	218	4	.889E+00
281	74	301	1	.138E+00
282	74	301	1	.710E-01
283	75	76	1	.120E+01
284	75	219	4	.889E+00
285	75	301	1	.157E+00
286	75	301	1	.900E-01
287	76	77	1	.125E+01
288	76	220	4	.655E+00
289	76	301	1	.171E+00
290	76	301	1	.980E-01
291	77	78	1	.210E+01
292	77	221	4	.655E+00
293	77	301	1	.172E+00
294	77	301	1	.980E-01
295	78	79	1	.172E+01
296	78	222	4	.542E+00
297	78	301	1	.131E+00
298	78	301	1	.920E-01
299	79	80	1	.992E+00
300	79	223	4	.815E+00
301	79	301	1	.111E+00
302	79	301	1	.920E-01
303	80	81	1	.108E+01
304	80	224	4	.990E+00
305	80	301	1	.940E-01
306	80	301	1	.920E-01
307	81	82	1	.146E+01
308	81	225	4	.701E+00
309	81	301	1	.840E-01
310	81	301	1	.840E-01
311	82	83	1	.146E+01
312	82	226	4	.701E+00
313	82	301	1	.840E-01
314	82	301	1	.840E-01
315	83	84	1	.146E+01
316	83	227	4	.701E+00
317	83	301	1	.840E-01
318	83	301	1	.840E-01
319	84	85	1	.146E+01
320	84	228	4	.701E+00
321	84	301	1	.840E-01
322	84	301	1	.840E-01
323	85	86	1	.146E+01
324	85	229	4	.701E+00
325	85	301	1	.840E-01
326	85	301	1	.840E-01
327	86	87	1	.146E+01
328	86	230	4	.701E+00
329	86	301	1	.840E-01
330	86	301	1	.840E-01
331	87	88	1	.146E+01
332	87	231	4	.701E+00
333	87	301	1	.840E-01
334	87	301	1	.840E-01
335	88	89	1	.146E+01
336	88	232	4	.701E+00

Brnh	From	To	Tag	Conduct
337	88	301	1	.840E-01
338	88	301	1	.840E-01
339	89	90	1	.146E+01
340	89	233	4	.701E+00
341	89	301	1	.840E-01
342	89	301	1	.840E-01
343	90	91	1	.146E+01
344	90	234	4	.701E+00
345	90	301	1	.840E-01
346	90	301	1	.840E-01
347	91	92	1	.146E+01
348	91	235	4	.701E+00
349	91	301	1	.840E-01
350	91	301	1	.840E-01
351	92	93	1	.146E+01
352	92	236	4	.701E+00
353	92	301	1	.840E-01
354	92	301	1	.840E-01
355	93	94	1	.146E+01
356	93	237	4	.701E+00
357	93	301	1	.840E-01
358	93	301	1	.840E-01
359	94	95	1	.146E+01
360	94	238	4	.701E+00
361	94	301	1	.840E-01
362	94	301	1	.840E-01
363	95	96	1	.146E+01
364	95	239	4	.701E+00
365	95	301	1	.840E-01
366	95	301	1	.840E-01
367	96	97	1	.129E+01
368	96	240	4	.701E+00
369	96	301	1	.840E-01
370	96	301	1	.840E-01
371	97	98	1	.115E+01
372	97	241	4	.889E+00
373	97	301	1	.900E-01
374	97	301	1	.970E-01
375	98	99	1	.115E+01
376	98	242	4	.889E+00
377	98	301	1	.710E-01
378	98	301	1	.125E+00
379	99	100	1	.115E+01
380	99	243	4	.889E+00
381	99	301	1	.320E-01
382	99	301	1	.149E+00
383	100	101	1	.115E+01
384	100	244	4	.889E+00
385	100	301	1	.320E-01
386	101	102	1	.115E+01
387	101	245	4	.889E+00
388	101	301	1	.920E-01
389	101	301	1	.710E-01
390	102	103	1	.129E+01
391	102	246	4	.889E+00
392	102	301	1	.124E+00
393	102	301	1	.900E-01
394	103	104	1	.146E+01
395	103	247	4	.701E+00
396	103	301	1	.840E-01
397	103	301	1	.840E-01
398	104	105	1	.146E+01
399	104	248	4	.701E+00
400	104	301	1	.840E-01
401	104	301	1	.840E-01
402	105	106	1	.146E+01
403	105	249	4	.701E+00
404	105	301	1	.840E-01
405	105	301	1	.840E-01
406	106	107	1	.146E+01
407	106	250	4	.701E+00
408	106	301	1	.840E-01
409	106	301	1	.840E-01
410	107	108	1	.146E+01
411	107	251	4	.701E+00
412	107	301	1	.840E-01
413	107	301	1	.840E-01
414	108	109	1	.146E+01
415	108	252	4	.701E+00
416	108	301	1	.840E-01
417	108	301	1	.840E-01
418	109	110	1	.146E+01
419	109	253	4	.701E+00
420	109	301	1	.840E-01
421	109	301	1	.840E-01
422	110	111	1	.146E+01
423	110	254	4	.701E+00
424	110	301	1	.840E-01
425	110	301	1	.840E-01
426	111	112	1	.146E+01
427	111	255	4	.701E+00
428	111	301	1	.840E-01
429	111	301	1	.840E-01
430	112	113	1	.146E+01
431	112	256	4	.701E+00
432	112	301	1	.840E-01
433	112	301	1	.840E-01
434	113	114	1	.146E+01
435	113	257	4	.701E+00
436	113	301	1	.840E-01
437	113	301	1	.840E-01
438	114	115	1	.146E+01
439	114	258	4	.701E+00
440	114	301	1	.840E-01
441	114	301	1	.840E-01
442	115	116	1	.146E+01
443	115	259	4	.701E+00
444	115	301	1	.840E-01
445	115	301	1	.840E-01
446	116	117	1	.146E+01
447	116	260	4	.701E+00
448	116	301	1	.840E-01
449	116	301	1	.840E-01
450	117	118	1	.146E+01
451	117	261	4	.701E+00
452	117	301	1	.840E-01
453	117	301	1	.840E-01
454	118	119	1	.129E+01
455	118	262	4	.701E+00
456	118	301	1	.840E-01
457	118	301	1	.840E-01
458	119	120	1	.115E+01
459	119	263	4	.889E+00
460	119	301	1	.900E-01
461	119	301	1	.940E-01
462	120	121	1	.115E+01
463	120	264	4	.889E+00
464	120	301	1	.710E-01
465	120	301	1	.111E+00
466	121	122	1	.115E+01
467	121	265	4	.889E+00
468	121	301	1	.320E-01
469	121	301	1	.131E+00
470	122	123	1	.115E+01
471	122	266	4	.889E+00
472	122	301	1	.320E-01
473	123	124	1	.115E+01
474	123	267	4	.889E+00
475	123	301	1	.710E-01
476	124	125	1	.129E+01
477	124	268	4	.889E+00
478	124	301	1	.900E-01
479	125	126	1	.146E+01
480	125	269	4	.701E+00
481	125	301	1	.490E-01
482	125	301	1	.840E-01
483	126	127	1	.146E+01
484	126	270	4	.701E+00
485	126	301	1	.680E-01
486	126	301	1	.840E-01
487	127	128	1	.146E+01
488	127	271	4	.701E+00
489	127	301	1	.820E-01
490	127	301	1	.840E-01
491	128	129	1	.146E+01
492	128	272	4	.701E+00
493	128	301	1	.910E-01
494	128	301	1	.840E-01
495	129	130	1	.146E+01
496	129	273	4	.701E+00
497	129	301	1	.970E-01
498	129	301	1	.840E-01
499	130	131	1	.146E+01
500	130	274	4	.701E+00
501	130	301	1	.100E+00
502	130	301	1	.840E-01
503	131	132	1	.146E+01
504	131	275	4	.701E+00

Brnh	From	To	Tag	Conduct
505	131	301	1	.101E+00
506	131	301	1	.840E-01
507	132	133	1	.146E+01
508	132	276	4	.701E+00
509	132	301	1	.100E+00
510	132	301	1	.840E-01
511	133	134	1	.146E+01
512	133	277	4	.701E+00
513	133	301	1	.970E-01
514	133	301	1	.840E-01
515	134	135	1	.146E+01
516	134	278	4	.701E+00
517	134	301	1	.910E-01
518	134	301	1	.840E-01
519	135	136	1	.146E+01
520	135	279	4	.701E+00
521	135	301	1	.820E-01
522	135	301	1	.840E-01
523	136	137	1	.146E+01
524	136	280	4	.701E+00
525	136	301	1	.680E-01
526	136	301	1	.840E-01
527	137	138	1	.146E+01
528	137	281	4	.701E+00
529	137	301	1	.490E-01
530	137	301	1	.840E-01
531	138	139	1	.146E+01
532	138	282	4	.701E+00
533	138	301	1	.240E-01
534	138	301	1	.840E-01
535	139	140	1	.146E+01
536	139	283	4	.701E+00
537	139	301	1	.840E-01
538	140	141	1	.160E+01
539	140	284	4	.701E+00
540	140	301	1	.840E-01
541	141	142	1	.178E+01
542	141	285	4	.576E+00
543	142	143	1	.178E+01
544	142	286	4	.576E+00
545	143	144	1	.178E+01
546	143	287	4	.576E+00
547	144	288	4	.576E+00
548	145	302	5	.174E+03
549	146	145	5	.174E+03
550	147	146	5	.174E+03
551	148	147	5	.174E+03
552	149	148	5	.174E+03
553	150	149	5	.174E+03
554	151	150	5	.174E+03
555	152	151	5	.174E+03
556	153	152	5	.174E+03
557	154	153	5	.174E+03
558	155	154	5	.174E+03
559	156	155	5	.174E+03
560	157	156	5	.174E+03
561	158	157	5	.174E+03
562	159	158	5	.174E+03
563	160	159	5	.174E+03
564	161	160	5	.174E+03
565	162	161	5	.174E+03
566	163	162	5	.174E+03
567	164	163	5	.174E+03
568	165	164	5	.174E+03
569	166	165	5	.174E+03
570	167	166	5	.174E+03
571	168	167	5	.174E+03
572	169	168	5	.174E+03
573	170	169	5	.174E+03
574	171	170	5	.174E+03
575	172	171	5	.174E+03
576	173	172	5	.174E+03
577	174	173	5	.174E+03
578	175	174	5	.174E+03
579	176	175	5	.174E+03
580	177	176	5	.174E+03
581	178	177	5	.174E+03
582	179	178	5	.174E+03
583	180	179	5	.174E+03
584	181	180	5	.174E+03
585	182	181	5	.174E+03
586	183	182	5	.174E+03
587	184	183	5	.174E+03
588	185	184	5	.174E+03
589	186	185	5	.174E+03
590	187	186	5	.174E+03
591	188	187	5	.174E+03
592	189	188	5	.174E+03
593	190	189	5	.174E+03
594	191	190	5	.174E+03
595	192	191	5	.174E+03
596	193	192	5	.174E+03
597	194	193	5	.174E+03
598	195	194	5	.174E+03
599	196	195	5	.174E+03
600	197	196	5	.174E+03
601	198	197	5	.174E+03
602	199	198	5	.174E+03
603	200	199	5	.174E+03
604	201	200	5	.174E+03
605	202	201	5	.174E+03
606	203	202	5	.174E+03
607	204	203	5	.174E+03
608	205	204	5	.174E+03
609	206	205	5	.174E+03
610	207	206	5	.174E+03
611	208	207	5	.174E+03
612	209	208	5	.174E+03
613	210	209	5	.174E+03
614	211	210	5	.174E+03
615	212	211	5	.174E+03
616	213	212	5	.174E+03
617	214	213	5	.174E+03
618	215	214	5	.174E+03
619	216	215	5	.174E+03
620	217	216	5	.174E+03
621	218	217	5	.174E+03
622	219	218	5	.174E+03
623	220	219	5	.174E+03
624	221	220	5	.174E+03
625	222	221	5	.174E+03
626	223	222	5	.174E+03
627	224	223	5	.174E+03
628	225	224	5	.174E+03
629	226	225	5	.174E+03
630	227	226	5	.174E+03
631	228	227	5	.174E+03
632	229	228	5	.174E+03
633	230	229	5	.174E+03
634	231	230	5	.174E+03
635	232	231	5	.174E+03
636	233	232	5	.174E+03
637	234	233	5	.174E+03
638	235	234	5	.174E+03
639	236	235	5	.174E+03
640	237	236	5	.174E+03
641	238	237	5	.174E+03
642	239	238	5	.174E+03
643	240	239	5	.174E+03
644	241	240	5	.174E+03
645	242	241	5	.174E+03
646	243	242	5	.174E+03
647	244	243	5	.174E+03
648	245	244	5	.174E+03
649	246	245	5	.174E+03
650	247	246	5	.174E+03
651	248	247	5	.174E+03
652	249	248	5	.174E+03
653	250	249	5	.174E+03
654	251	250	5	.174E+03
655	252	251	5	.174E+03
656	253	252	5	.174E+03
657	254	253	5	.174E+03
658	255	254	5	.174E+03
659	256	255	5	.174E+03
660	257	256	5	.174E+03
661	258	257	5	.174E+03
662	259	258	5	.174E+03
663	260	259	5	.174E+03
664	261	260	5	.174E+03
665	262	261	5	.174E+03
666	263	262	5	.174E+03
667	264	263	5	.174E+03
668	265	264	5	.174E+03
669	266	265	5	.174E+03
670	267	266	5	.174E+03
671	268	267	5	.174E+03
672	269	268	5	.174E+03

Brnh	From	To	Tag	Conduct
673	270	269	5	.174E+03
674	271	270	5	.174E+03
675	272	271	5	.174E+03
676	273	272	5	.174E+03
677	274	273	5	.174E+03
678	275	274	5	.174E+03
679	276	275	5	.174E+03
680	277	276	5	.174E+03
681	278	277	5	.174E+03
682	279	278	5	.174E+03
683	280	279	5	.174E+03
684	281	280	5	.174E+03
685	282	281	5	.174E+03
686	283	282	5	.174E+03
687	284	283	5	.174E+03
688	285	284	5	.174E+03
689	286	285	5	.174E+03
690	287	286	5	.174E+03
691	288	287	5	.174E+03

TASS GENERAL INPUT MENU - SI Units

(1) Case Title:
TALSR(METRIC)----RUN 2. COMPLEX MODEL 149.7 kg/hr (330 lbm/hr)

(2) Nodes	288
(3) Constant Temperatures	2
(4) Unique Exponents	0
(5) Temperature Dependent Conductances	0
(6) Temperature Dependent Heat Inputs	0
(7) Computational Accuracy	.0100
(8) Starting Temperature	25.0

Are these inputs correct (Y/N) ? Y

NODE	TEMPERATURE	ABSOLUTE VALUE OF THETA (b)
	(Celsius)	(Celsius)
5	26.34	13.66
6	26.63	13.37
7	26.91	13.09
8	27.19	12.81
9	27.42	12.58
10	27.62	12.38
11	27.77	12.23
12	27.88	12.12
13	27.95	12.05
14	27.98	12.02
15	27.97	12.03
16	27.93	12.07
17	27.85	12.15
18	27.73	12.27
19	27.57	12.43
20	27.38	12.62
21	27.15	12.85
22	27.01	12.99
23	27.02	12.98
24	27.29	12.71
25	27.52	12.48
26	27.7	12.3
27	27.84	12.16
28	27.93	12.07
29	27.99	12.01
30	28.04	11.96
31	28.07	11.93
32	28.1	11.9
33	28.12	11.88
34	28.13	11.87
35	28.14	11.86
36	28.15	11.85
37	28.15	11.85
38	28.15	11.85
39	28.14	11.86
40	28.12	11.88
41	28.09	11.91
42	28.04	11.96
43	27.94	12.06
44	27.77	12.23
45	27.61	12.39
46	27.78	12.22
47	27.93	12.07
48	28.03	11.97
49	28.13	11.87
50	28.19	11.81
51	28.24	11.76
52	28.27	11.73

53	28.3	11.7
54	28.32	11.68
55	28.34	11.66
56	28.35	11.65
57	28.37	11.63
58	28.38	11.62
59	28.39	11.61
60	28.41	11.59
61	28.42	11.58
62	28.44	11.56
63	28.47	11.53
64	28.5	11.5
65	28.56	11.44
66	28.8	11.2
67	28.98	11.02
68	29.04	10.96
69	29	11
70	28.78	11.22
71	28.53	11.47
72	28.31	11.69
73	28.32	11.68
74	28.57	11.43
75	28.83	11.17
76	29.07	10.93
77	29.14	10.86
78	29.09	10.91
79	28.93	11.07
80	28.72	11.28
81	28.68	11.32
82	28.67	11.33
83	28.66	11.34
84	28.66	11.34
85	28.66	11.34
86	28.67	11.33
87	28.67	11.33
88	28.68	11.32
89	28.68	11.32
90	28.68	11.32
91	28.68	11.32
92	28.68	11.32
93	28.67	11.33
94	28.66	11.34
95	28.63	11.37
96	28.59	11.41
97	28.51	11.49
98	28.43	11.57
99	28.31	11.69
100	28.17	11.83
101	28.34	11.66
102	28.52	11.48

103	28.63	11.37
104	28.69	11.31
105	28.74	11.26
106	28.78	11.22
107	28.8	11.2
108	28.82	11.18
109	28.84	11.16
110	28.85	11.15
111	28.85	11.15
112	28.86	11.14
113	28.86	11.14
114	28.85	11.15
115	28.84	11.16
116	28.81	11.19
117	28.77	11.23
118	28.7	11.3
119	28.58	11.42
120	28.44	11.56
121	28.25	11.75
122	28.01	11.99
123	28.02	11.98
124	28.16	11.84
125	28.4	11.6
126	28.59	11.41
127	28.74	11.26
128	28.87	11.13
129	28.96	11.04
130	29.01	10.99
131	29.03	10.97
132	29.02	10.98
133	28.97	11.03
134	28.89	11.11
135	28.77	11.23
136	28.61	11.39
137	28.4	11.6
138	28.17	11.83
139	27.92	12.08
140	27.67	12.33

INPUT DATA

Fin Length (L) (cm)	Fin Thickness (cm)	Fin spacing (z) (cm)	Thermal Conductivity of Copper (k) (W/cm-K)	Reynolds Number	Prandtl Number	Outer pipe radius (cm)	Inner pipe radius (cm)	Pipe Area (sq. cm.)
0.318	0.015	0.053	4.01	1900.00000	0.707	0.635	0.483	0.535

Nodal Fin Sharing Pairs	Channel Width (b) (cm)	Effective Diameter (cm)	Heat Transfer Coefficent (h) (W/sqcm-K)	m (1/cm)	Lambda	R-Theta	b2-Term (cm)	b1-Term (cm)
5-42	1.143	0.10192	0.03626	1.08929	3.473	1.142	0.461	0.682
6-41	1.143	0.10192	0.03626	1.08929	3.473	1.123	0.475	0.668
7-40	1.143	0.10192	0.03626	1.08929	3.473	1.102	0.491	0.652
8-39	1.143	0.10192	0.03626	1.08929	3.473	1.080	0.508	0.635
9-38	1.143	0.10192	0.03626	1.08929	3.473	1.062	0.522	0.621
10-37	1.143	0.10192	0.03626	1.08929	3.473	1.045	0.535	0.608
11-36	1.143	0.10192	0.03626	1.08929	3.473	1.032	0.545	0.598
12-35	1.143	0.10192	0.03626	1.08929	3.473	1.022	0.553	0.590
13-34	1.143	0.10192	0.03626	1.08929	3.473	1.015	0.559	0.584
14-33	1.143	0.10192	0.03626	1.08929	3.473	1.012	0.562	0.581
15-32	1.143	0.10192	0.03626	1.08929	3.473	1.011	0.562	0.581
16-31	1.143	0.10192	0.03626	1.08929	3.473	1.012	0.562	0.581
17-30	1.143	0.10192	0.03626	1.08929	3.473	1.016	0.558	0.585
18-29	1.143	0.10192	0.03626	1.08929	3.473	1.022	0.553	0.590
19-28	1.143	0.10192	0.03626	1.08929	3.473	1.030	0.547	0.596
20-27	1.143	0.10192	0.03626	1.08929	3.473	1.038	0.541	0.602
21-26	1.104	0.10176	0.03629	1.08986	3.331	1.045	0.514	0.590
22-25	0.808	0.10008	0.03670	1.09596	2.425	1.041	0.360	0.448
23-24	0.296	0.09038	0.03928	1.13381	1.399	1.021	0.093	0.203
24-67	2.037	0.10396	0.03578	1.08214	9.066	1.153	0.936	1.101
25-66	1.496	0.10301	0.03600	1.08545	5.075	1.114	0.674	0.822
26-65	1.184	0.10208	0.03622	1.08873	3.630	1.075	0.534	0.651
27-64	1.143	0.10192	0.03626	1.08929	3.473	1.057	0.525	0.618
28-63	1.143	0.10192	0.03626	1.08929	3.473	1.047	0.533	0.610
29-62	1.143	0.10192	0.03626	1.08929	3.473	1.039	0.540	0.603
30-61	1.143	0.10192	0.03626	1.08929	3.473	1.033	0.545	0.598
31-60	1.143	0.10192	0.03626	1.08929	3.473	1.029	0.548	0.595
32-59	1.143	0.10192	0.03626	1.08929	3.473	1.025	0.551	0.592
33-58	1.143	0.10192	0.03626	1.08929	3.473	1.022	0.553	0.590
34-57	1.143	0.10192	0.03626	1.08929	3.473	1.021	0.554	0.589
35-56	1.143	0.10192	0.03626	1.08929	3.473	1.018	0.557	0.586
36-55	1.143	0.10192	0.03626	1.08929	3.473	1.016	0.558	0.585
37-54	1.143	0.10192	0.03626	1.08929	3.473	1.015	0.559	0.584
38-53	1.143	0.10192	0.03626	1.08929	3.473	1.013	0.561	0.582
39-52	1.143	0.10192	0.03626	1.08929	3.473	1.011	0.562	0.581
40-51	1.143	0.10192	0.03626	1.08929	3.473	1.010	0.563	0.580

41-50	1.143	0.10192	0.03626	1.08929	3.473	1.008	0.565	0.578
42-49	1.143	0.10192	0.03626	1.08929	3.473	1.008	0.565	0.578
43-48	1.104	0.10176	0.03629	1.08986	3.331	1.008	0.545	0.559
44-47	0.808	0.10008	0.03670	1.09596	2.425	1.013	0.390	0.418
45-46	0.296	0.09038	0.03928	1.13381	1.399	1.014	0.111	0.185
46-99	2.931	0.10477	0.03560	1.07932	23.665	1.045	1.444	1.488
47-98	1.850	0.10369	0.03584	1.08307	7.414	1.043	0.899	0.950
48-97	1.225	0.10223	0.03618	1.08820	3.794	1.042	0.580	0.645
49-96	1.143	0.10192	0.03626	1.08929	3.473	1.040	0.539	0.604
50-95	1.143	0.10192	0.03626	1.08929	3.473	1.039	0.540	0.603
51-94	1.143	0.10192	0.03626	1.08929	3.473	1.037	0.541	0.602
52-93	1.143	0.10192	0.03626	1.08929	3.473	1.035	0.543	0.600
53-92	1.143	0.10192	0.03626	1.08929	3.473	1.034	0.544	0.599
54-91	1.143	0.10192	0.03626	1.08929	3.473	1.032	0.545	0.598
55-90	1.143	0.10192	0.03626	1.08929	3.473	1.030	0.547	0.596
56-89	1.143	0.10192	0.03626	1.08929	3.473	1.029	0.548	0.595
57-88	1.143	0.10192	0.03626	1.08929	3.473	1.027	0.549	0.594
58-87	1.143	0.10192	0.03626	1.08929	3.473	1.026	0.550	0.593
59-86	1.143	0.10192	0.03626	1.08929	3.473	1.025	0.551	0.592
60-85	1.143	0.10192	0.03626	1.08929	3.473	1.022	0.553	0.590
61-84	1.143	0.10192	0.03626	1.08929	3.473	1.021	0.554	0.589
62-83	1.143	0.10192	0.03626	1.08929	3.473	1.019	0.556	0.587
63-82	1.143	0.10192	0.03626	1.08929	3.473	1.018	0.557	0.586
64-81	1.143	0.10192	0.03626	1.08929	3.473	1.016	0.558	0.585
65-80	1.143	0.10192	0.03626	1.08929	3.473	1.014	0.560	0.583
66-79	1.143	0.10192	0.03626	1.08929	3.473	1.012	0.562	0.581
67-78	1.143	0.10192	0.03626	1.08929	3.473	1.010	0.563	0.580
68-77	1.143	0.10192	0.03626	1.08929	3.473	1.009	0.564	0.579
69-76	1.143	0.10192	0.03626	1.08929	3.473	1.006	0.567	0.576
70-75	1.104	0.10176	0.03629	1.08986	3.331	1.004	0.549	0.555
71-74	0.808	0.10008	0.03670	1.09596	2.425	1.003	0.401	0.407
72-73	0.296	0.09038	0.03928	1.13381	1.399	1.001	0.145	0.151
78-121	2.037	0.10396	0.03578	1.08214	9.066	0.929	1.061	0.976
79-120	1.496	0.10301	0.03600	1.08545	5.075	0.958	0.778	0.719
80-119	1.184	0.10208	0.03622	1.08873	3.630	0.988	0.602	0.582
81-118	1.143	0.10192	0.03626	1.08929	3.473	1.002	0.570	0.573
82-117	1.143	0.10192	0.03626	1.08929	3.473	1.009	0.564	0.579
83-116	1.143	0.10192	0.03626	1.08929	3.473	1.013	0.561	0.582
84-115	1.143	0.10192	0.03626	1.08929	3.473	1.016	0.558	0.585
85-114	1.143	0.10192	0.03626	1.08929	3.473	1.017	0.558	0.585
86-113	1.143	0.10192	0.03626	1.08929	3.473	1.017	0.558	0.585
87-112	1.143	0.10192	0.03626	1.08929	3.473	1.017	0.558	0.585
88-111	1.143	0.10192	0.03626	1.08929	3.473	1.015	0.559	0.584
89-110	1.143	0.10192	0.03626	1.08929	3.473	1.015	0.559	0.584
90-109	1.143	0.10192	0.03626	1.08929	3.473	1.014	0.560	0.583
91-108	1.143	0.10192	0.03626	1.08929	3.473	1.013	0.561	0.582
92-107	1.143	0.10192	0.03626	1.08929	3.473	1.011	0.562	0.581

93-106	1.143	0.10192	0.03626	1.08929	3.473	1.010	0.563	0.580
94-105	1.143	0.10192	0.03626	1.08929	3.473	1.007	0.566	0.577
95-104	1.143	0.10192	0.03626	1.08929	3.473	1.005	0.567	0.576
96-103	1.143	0.10192	0.03626	1.08929	3.473	1.004	0.568	0.575
97-102	1.104	0.10176	0.03629	1.08986	3.331	1.001	0.551	0.553
98-101	0.808	0.10008	0.03670	1.09596	2.425	0.992	0.413	0.395
99-100	0.296	0.09038	0.03928	1.13381	1.399	0.988	0.180	0.116
103-140	1.143	0.10192	0.03626	1.08929	3.473	0.922	0.639	0.504
104-139	1.143	0.10192	0.03626	1.08929	3.473	0.936	0.626	0.517
105-138	1.143	0.10192	0.03626	1.08929	3.473	0.952	0.612	0.531
106-137	1.143	0.10192	0.03626	1.08929	3.473	0.967	0.599	0.544
107-136	1.143	0.10192	0.03626	1.08929	3.473	0.983	0.586	0.557
108-135	1.143	0.10192	0.03626	1.08929	3.473	0.996	0.575	0.568
109-134	1.143	0.10192	0.03626	1.08929	3.473	1.005	0.567	0.576
110-133	1.143	0.10192	0.03626	1.08929	3.473	1.011	0.562	0.581
111-132	1.143	0.10192	0.03626	1.08929	3.473	1.015	0.559	0.584
112-131	1.143	0.10192	0.03626	1.08929	3.473	1.015	0.559	0.584
113-130	1.143	0.10192	0.03626	1.08929	3.473	1.014	0.560	0.583
114-129	1.143	0.10192	0.03626	1.08929	3.473	1.010	0.563	0.580
115-128	1.143	0.10192	0.03626	1.08929	3.473	1.003	0.569	0.574
116-127	1.143	0.10192	0.03626	1.08929	3.473	0.994	0.576	0.567
117-126	1.143	0.10192	0.03626	1.08929	3.473	0.984	0.585	0.558
118-125	1.143	0.10192	0.03626	1.08929	3.473	0.974	0.593	0.550
119-124	1.104	0.10176	0.03629	1.08986	3.331	0.965	0.582	0.522
120-123	0.808	0.10008	0.03670	1.09596	2.425	0.965	0.443	0.365
121-122	0.296	0.09038	0.03928	1.13381	1.399	0.980	0.202	0.094

INPUT DATA

Fin Length (L) (cm)	Fin Thickness (cm)	Fin spacing (z) (cm)	Thermal Conductivity of Copper (k) (W/cm-K)	Reynolds Number	Prandtl Number	Outer pipe diameter (cm)	Inner pipe diameter (cm)	Pipe Area (sq. cm.)
0.318	0.015	0.0533	4.01	1900.00	0.707	0.635	0.483	0.134

K-Value	Channel Width (b) (cm)	Effective Diameter (cm)	Heat Transfer Coefficent (h) (W/sqcm-K)	b-Term (cm)	Yin,f (W/K)	Dist. between Nodes (cm)	Fins/node	K - Value (W/K)
K1			N/A			0.302	N/A	1.7784
K2			1.260			0.302	N/A	0.5762
K3			N/A			0.334	N/A	1.6043
K4			N/A			0.367	N/A	1.4612
K5			1.260			0.367	N/A	0.7013
K6	1.143	0.1019	0.03626	0.68200	0.01333	0.367	6.880	0.0954
K7	1.143	0.1019	0.03626	0.66800	0.01314	0.367	6.880	0.0940
K8	1.143	0.1019	0.03626	0.65200	0.01291	0.367	6.880	0.0924
K9	0.094	0.0681	0.04746		0.00282	0.367	6.880	0.0241
K10	1.143	0.1019	0.03626	0.63500	0.01266	0.367	6.880	0.0907
K11	0.269	0.0890	0.03967		0.00658	0.367	6.880	0.0492
K12	1.143	0.1019	0.03626	0.62100	0.01245	0.367	6.880	0.0893
K13	0.414	0.0945	0.03813		0.00937	0.367	6.880	0.0682
K14	1.143	0.1019	0.03626	0.60800	0.01226	0.367	6.880	0.0879
K15	0.531	0.0969	0.03749		0.01136	0.367	6.880	0.0819
K16	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K17	0.620	0.0982	0.03716		0.01271	0.367	6.880	0.0911
K18	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K19	0.881	0.0989	0.03698		0.01354	0.367	6.880	0.0969
K20	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K21	0.716	0.0993	0.03690		0.01400	0.367	6.880	0.1000
K22	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K23	0.732	0.0994	0.03686		0.01419	0.367	6.880	0.1013
K24	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K25	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K26	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K27	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K28	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
K29			N/A			0.416	N/A	1.2907
K30	1.143	0.1019	0.03626	0.60200	0.01216	0.367	6.880	0.0873
K31			N/A			0.465	N/A	1.1524
K32			1.260			0.465	N/A	0.8892
K33	1.104	0.1018	0.03629	0.59000	0.01199	0.465	7.540	0.0944
K34	0.808	0.1001	0.03670	0.44800	0.00968	0.465	7.540	0.0770
K35	0.296	0.0904	0.03928	0.20300	0.00498	0.465	7.540	0.0419
K36	2.037	0.1040	0.03578	1.10100	0.01745	0.465	7.540	0.1355
K37	0.296	0.0904	0.03928	0.09300	0.00231	0.465	7.540	0.0218
K38	1.496	0.1030	0.03600	0.82200	0.01501	0.465	7.540	0.1171
K39	0.808	0.1001	0.03670	0.36000	0.00798	0.465	7.540	0.0642
K40	1.184	0.1021	0.03622	0.65100	0.01288	0.465	7.540	0.1012
K41	1.104	0.1018	0.03629	0.51400	0.01075	0.465	7.540	0.0850

K42	1.143	0.1019	0.03626	0.61800	0.01241	0.367	6.880	0.0890
K43	1.143	0.1019	0.03626	0.54100	0.01119	0.367	6.880	0.0806
K44	1.143	0.1019	0.03626	0.61000	0.01229	0.367	6.880	0.0881
K45	1.143	0.1019	0.03626	0.54700	0.01129	0.367	6.880	0.0813
K46	1.143	0.1019	0.03626	0.60300	0.01218	0.367	6.880	0.0874
K47	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K48	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K49	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K50	1.143	0.1019	0.03626	0.59500	0.01206	0.367	6.880	0.0866
K51	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K52	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K53	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K54	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K55	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K56	1.143	0.1019	0.03626	0.58900	0.01196	0.367	6.880	0.0859
K57	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K58	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K59	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K60	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K61	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K62	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K63	1.143	0.1019	0.03626	0.53500	0.01109	0.367	6.880	0.0799
K64	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K65	1.143	0.1019	0.03626	0.52200	0.01087	0.367	6.880	0.0784
K66	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K67	1.143	0.1019	0.03626	0.50800	0.01063	0.367	6.880	0.0768
K68	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K69	1.143	0.1019	0.03626	0.49100	0.01034	0.367	6.880	0.0747
K70	1.143	0.1019	0.03626	0.57800	0.01179	0.367	6.880	0.0847
K71	1.143	0.1019	0.03626	0.47500	0.01005	0.367	6.880	0.0728
K72	1.143	0.1019	0.03626	0.57800	0.01179	0.367	6.880	0.0847
K73	1.143	0.1019	0.03626	0.46100	0.00980	0.367	6.880	0.0711
K74	1.104	0.1018	0.03629	0.55900	0.01150	0.465	7.540	0.0907
K75	0.888	0.1006	0.03657		0.01591	0.465	7.540	0.1240
K76	0.808	0.1001	0.03670	0.41800	0.00911	0.465	7.540	0.0728
K77	0.550	0.0973	0.03741		0.01167	0.465	7.540	0.0921
K78	0.296	0.0904	0.03928	0.18500	0.00455	0.465	7.540	0.0386
K79	2.931	0.1048	0.03560	1.48800	0.01932	0.465	7.540	0.1496
K80	0.296	0.0904	0.03928	0.11100	0.00275	0.465	7.540	0.0251
K81	1.850	0.1037	0.03584	0.95000	0.01625	0.465	7.540	0.1265
K82	0.808	0.1001	0.03670	0.39000	0.00857	0.465	7.540	0.0687
K83	1.225	0.1022	0.03618	0.64500	0.01279	0.465	7.540	0.1004
K84	1.104	0.1018	0.03629	0.54500	0.01127	0.465	7.540	0.0890
K85	1.143	0.1019	0.03626	0.60400	0.01220	0.367	6.880	0.0875
K86	1.143	0.1019	0.03626	0.56500	0.01158	0.367	6.880	0.0833
K87	1.143	0.1019	0.03626	0.60300	0.01218	0.367	6.880	0.0874
K88	1.143	0.1019	0.03626	0.56500	0.01158	0.367	6.880	0.0833
K89	1.143	0.1019	0.03626	0.60200	0.01216	0.367	6.880	0.0873
K90	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K91	1.143	0.1019	0.03626	0.60000	0.01213	0.367	6.880	0.0871
K92	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K93	1.143	0.1019	0.03626	0.59900	0.01212	0.367	6.880	0.0870

K94	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K95	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K96	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K97	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
K98	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K99	1.143	0.1019	0.03626	0.59500	0.01206	0.367	6.880	0.0866
K100	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K101	1.143	0.1019	0.03626	0.59400	0.01204	0.367	6.880	0.0864
K102	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K103	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K104	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K105	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K106	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K107	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K108	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K109	1.143	0.1019	0.03626	0.58900	0.01196	0.367	6.880	0.0859
K110	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K111	1.143	0.1019	0.03626	0.58700	0.01193	0.367	6.880	0.0857
K112	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K113	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K114	1.143	0.1019	0.03626	0.53300	0.01108	0.367	6.880	0.0797
K115			N/A			0.496	N/A	1.0819
K116	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K117	1.143	0.1019	0.03626	0.52500	0.01092	0.367	6.880	0.0788
K118			N/A			0.541	N/A	0.992
K119			1.260			0.518	N/A	0.990
K120	1.143	0.1019	0.03626	0.58300	0.01187	0.541	7.540	0.0935
K121	1.184	0.1021	0.03622	0.53400	0.01106	0.541	7.540	0.0874
K122			N/A			0.312	N/A	1.717
K123			1.260			0.427	N/A	0.815
K124	1.143	0.1019	0.03626	0.58100	0.01184	0.312	7.540	0.0933
K125	1.496	0.1030	0.03600	0.67400	0.01314	0.312	7.540	0.1031
K126			N/A			0.255	N/A	2.100
K127			1.260			0.284	N/A	0.542
K128	1.143	0.1019	0.03626	0.58000	0.01182	0.255	7.540	0.0931
K129	2.037	0.1040	0.03578	0.93600	0.01810	0.255	7.540	0.1254
K130			N/A			0.429	N/A	1.251
K131			1.260			0.343	N/A	0.655
K132	1.143	0.1019	0.03626	0.57900	0.01181	0.429	8.040	0.0992
K133	2.907	0.10476	0.03560		0.02086	0.429	8.040	0.1720
K134			N/A			0.447	N/A	1.200
K135	1.143	0.1019	0.03626	0.57600	0.01176	0.429	8.040	0.0989
K136	2.482	0.10444	0.03567		0.02077	0.429	8.040	0.1712
K137	1.104	0.1018	0.03629	0.55500	0.01143	0.465	7.540	0.0902
K138	1.840	0.10368	0.03585		0.02025	0.465	7.540	0.1567
K139	0.808	0.1001	0.03670	0.40700	0.00890	0.465	7.540	0.0712
K140	1.119	0.10182	0.03628		0.01775	0.465	7.540	0.1378
K141	0.296	0.0904	0.03928	0.15100	0.00373	0.465	7.540	0.0325
K142	0.359	0.09288	0.03857		0.00834	0.465	7.540	0.0672
K143	0.296	0.0904	0.03928	0.14500	0.00358	0.465	7.540	0.0314
K144	0.808	0.1001	0.03670	0.40100	0.00879	0.465	7.540	0.0703
K145	1.104	0.1018	0.03629	0.54900	0.01133	0.465	7.540	0.0895

K146	1.143	0.1019	0.03626	0.56700	0.01161	0.429	8.040	0.0977
K147	1.143	0.1019	0.03626	0.56400	0.01157	0.429	8.040	0.0973
K148	2.037	0.1040	0.03578	0.97600	0.01647	0.255	7.540	0.1242
K149	1.143	0.1019	0.03626	0.56300	0.01155	0.255	7.540	0.0911
K150	1.496	0.1030	0.03600	0.71900	0.01375	0.312	7.540	0.1077
K151	1.143	0.1019	0.03626	0.56200	0.01153	0.312	7.540	0.0870
K152	1.184	0.1021	0.03622	0.58200	0.01184	0.541	7.540	0.0933
K153	1.143	0.1019	0.03626	0.56000	0.01150	0.541	7.540	0.0907
K154	1.143	0.1019	0.03626	0.57300	0.01171	0.367	6.880	0.0842
K155	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K156	1.143	0.1019	0.03626	0.57900	0.01181	0.367	6.880	0.0848
K157	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K158	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K159	1.143	0.1019	0.03626	0.55600	0.01144	0.367	6.880	0.0823
K160	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K161	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K162	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K163	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K164	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K165	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K166	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K167	1.143	0.1019	0.03626	0.55000	0.01134	0.367	6.880	0.0816
K168	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K169	1.143	0.1019	0.03626	0.54900	0.01132	0.367	6.880	0.0815
K170	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K171	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K172	1.143	0.1019	0.03626	0.58300	0.01187	0.367	6.880	0.0853
K173	1.143	0.1019	0.03626	0.54700	0.01129	0.367	6.880	0.0813
K174	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K175	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K176	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K177	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.880	0.0809
K178	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K179	1.143	0.1019	0.03626	0.54300	0.01122	0.367	6.880	0.0808
K180	1.143	0.1019	0.03626	0.57700	0.01177	0.367	6.880	0.0846
K181	1.143	0.1019	0.03626	0.54100	0.01119	0.367	6.880	0.0806
K182	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K183	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K184	1.143	0.1019	0.03626	0.57500	0.01174	0.367	6.880	0.0844
K185	1.143	0.1019	0.03626	0.53900	0.01116	0.367	6.880	0.0804
K186	1.104	0.1018	0.03629	0.55300	0.01140	0.465	7.540	0.0900
K187	1.225	0.1022	0.03618	0.58000	0.01180	0.465	7.540	0.0930
K188	0.808	0.1001	0.03670	0.39500	0.00867	0.465	7.540	0.0694
K189	1.850	0.1037	0.03584	0.89900	0.01577	0.465	7.540	0.1229
K190	0.296	0.0904	0.03928	0.11600	0.00288	0.465	7.540	0.0260
K191	2.931	0.1048	0.03560	1.44400	0.01917	0.465	7.540	0.1485
K192	0.296	0.0904	0.03928	0.18000	0.00443	0.465	7.540	0.0377
K193	0.808	0.1001	0.03670	0.41300	0.00902	0.465	7.540	0.0721
K194	1.104	0.1018	0.03629	0.55100	0.01136	0.465	7.540	0.0897
K195	1.143	0.1019	0.03626	0.50400	0.01056	0.367	6.880	0.0763
K196	1.143	0.1019	0.03626	0.56800	0.01163	0.367	6.880	0.0836
K197	1.143	0.1019	0.03626	0.51700	0.01079	0.367	6.880	0.0778

K198	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K199	1.143	0.1019	0.03626	0.53100	0.01102	0.367	6.880	0.0794
K200	1.143	0.1019	0.03626	0.56600	0.01160	0.367	6.880	0.0834
K201	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.880	0.0809
K202	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K203	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K204	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K205	1.143	0.1019	0.03626	0.56800	0.01163	0.367	6.880	0.0836
K206	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K207	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K208	1.143	0.1019	0.03626	0.56000	0.01150	0.367	6.880	0.0827
K209	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K210	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K211	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K212	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K213	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K214	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K215	1.143	0.1019	0.03626	0.58300	0.01167	0.367	6.880	0.0853
K216	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0625
K217	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K218	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K219	1.143	0.1019	0.03626	0.57400	0.01173	0.367	6.880	0.0843
K220	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K221	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K222	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K223	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K224	1.143	0.1019	0.03626	0.56400	0.01157	0.367	6.880	0.0832
K225	1.143	0.1019	0.03626	0.55000	0.01134	0.367	6.880	0.0816
K226	1.143	0.1019	0.03626	0.57000	0.01166	0.367	6.880	0.0838
K227	1.104	0.1018	0.03629	0.52200	0.01088	0.465	7.540	0.0861
K228	1.184	0.1021	0.03622	0.60200	0.01215	0.465	7.540	0.0956
K229	0.808	0.1001	0.03670	0.36500	0.00808	0.465	7.540	0.0650
K230	1.498	0.1030	0.03600	0.77800	0.01449	0.465	7.540	0.1133
K231	0.296	0.0904	0.03928	0.09400	0.00234	0.465	7.540	0.0220
K232	2.037	0.1040	0.03578	1.06100	0.01716	0.465	7.540	0.1333
K233	0.296	0.0904	0.03928	0.20200	0.00495	0.465	7.540	0.0417
K234	0.808	0.1001	0.03870	0.44300	0.00958	0.465	7.540	0.0763
K235	1.104	0.1018	0.03629	0.58200	0.01186	0.465	7.540	0.0936
K236	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K237	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K238	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K239	1.143	0.1019	0.03626	0.56900	0.01165	0.367	6.880	0.0837
K240	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K241	1.143	0.1019	0.03626	0.56000	0.01150	0.367	6.880	0.0827
K242	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K243	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K244	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K245	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K246	1.143	0.1019	0.03626	0.57500	0.01174	0.367	6.880	0.0844
K247	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K248	1.143	0.1019	0.03626	0.59900	0.01212	0.367	6.880	0.0870
K249	1.143	0.1019	0.03626	0.61200	0.01232	0.367	6.880	0.0884

K250	1.143	0.1019	0.03626	0.62600	0.01253	0.367	6.880	0.0898
K251	1.143	0.1019	0.03626	0.63900	0.01272	0.367	6.880	0.0911
K252	N/A	N/A	N/A	N/A	N/A	N/A	N/A	173.8900

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S,
1	1	2	1	K1	51	16	17	1	S9
2		145	4	K2	52		160	4	S10
3	2	3	1	S1	53		301	1	K25
4		146	4	S2	54		301	1	S38
5	3	4	1	S1	55	17	18	1	S9
6		147	4	S2	56		161	4	S10
7	4	5	1	K3	57		301	1	K26
8		148	4	S2	58		301	1	S34
9	5	6	1	K4	59	18	19	1	S9
10		149	4	K5	60		162	4	S10
11		301	1	K6	61		301	1	K27
12	6	7	1	S9	62		301	1	S30
13		150	4	S10	63	19	20	1	S9
14		301	1	K7	64		163	4	S10
15	7	8	1	S9	65		301	1	K28
16		151	4	S10	66		301	1	S26
17		301	1	K8	67	20	21	1	K29
18		301	1	K9	68		164	4	S10
19	8	9	1	S9	69		301	1	K30
20		152	4	S10	70		301	1	S22
21		301	1	K10	71	21	22	1	K31
22		301	1	K11	72		165	4	K32
23	9	10	1	S9	73		301	1	K33
24		153	4	S10	74	22	23	1	S71
25		301	1	K12	75		166	4	S72
26		301	1	K13	76		301	1	K34
27	10	11	1	S9	77	23	24	1	S71
28		154	4	S10	78		167	4	S72
29		301	1	K14	79		301	1	K35
30		301	1	K15	80	24	25	1	S71
31	11	12	1	S9	81		168	4	S72
32		155	4	S10	82		301	1	K36
33		301	1	K16	83		301	1	K37
34		301	1	K17	84	25	26	1	S71
35	12	13	1	S9	85		169	4	S72
36		156	4	S10	86		301	1	K38
37		301	1	K18	87		301	1	K39
38		301	1	K19	88	26	27	1	S67
39	13	14	1	S9	89		170	4	S72
40		157	4	S10	90		301	1	K40
41		301	1	K20	91		301	1	K41
42		301	1	K21	92	27	28	1	S9
43	14	15	1	S9	93		171	4	S10
44		158	4	S10	94		301	1	K42
45		301	1	K22	95		301	1	K43
46		301	1	K23	96	28	29	1	S9
47	15	16	1	S9	97		172	4	S10
48		159	4	S10	98		301	1	K44
49		301	1	K24	99		301	1	K45
50		301	1	S42	100	29	30	1	S9

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S,
101		173	4	S10	151		301	1	K71
102		301	1	K46	152	42	43	1	S67
103		301	1	K47	153		186	4	S10
104	30	31	1	S9	154		301	1	K72
105		174	4	S10	155		301	1	K73
106		301	1	K48	156	43	44	1	S71
107		301	1	K49	157		187	4	S72
108	31	32	1	S9	158		301	1	K74
109		175	4	S10	159		301	1	K75
110		301	1	K50	160	44	45	1	S71
111		301	1	K51	161		188	4	S72
112	32	33	1	S9	162		301	1	K76
113		176	4	S10	163		301	1	K77
114		301	1	K52	164	45	46	1	S71
115		301	1	K53	165		189	4	S72
116	33	34	1	S9	166		301	1	K78
117		177	4	S10	167	46	47	1	S71
118		301	1	K54	168		190	4	S72
119		301	1	K55	169		301	1	K79
120	34	35	1	S9	170		301	1	K80
121		178	4	S10	171	47	48	1	S71
122		301	1	K56	172		191	4	S72
123		301	1	K57	173		301	1	K81
124	35	36	1	S9	174		301	1	K82
125		179	4	S10	175	48	49	1	S67
126		301	1	K58	176		192	4	S72
127		301	1	K59	177		301	1	K83
128	36	37	1	S9	178		301	1	K84
129		180	4	S10	179	49	50	1	S9
130		301	1	K60	180		193	4	S10
131		301	1	K61	181		301	1	K85
132	37	38	1	S9	182		301	1	K86
133		181	4	S10	183	50	51	1	S9
134		301	1	K62	184		194	4	S10
135		301	1	K63	185		301	1	K87
136	38	39	1	S9	186		301	1	K88
137		182	4	S10	187	51	52	1	S9
138		301	1	K64	188		195	4	S10
139		301	1	K65	189		301	1	K89
140	39	40	1	S9	190		301	1	K90
141		183	4	S10	191	52	53	1	S9
142		301	1	K66	192		196	4	S10
143		301	1	K67	193		301	1	K91
144	40	41	1	S9	194		301	1	K92
145		184	4	S10	195	53	54	1	S9
146		301	1	K68	196		197	4	S10
147		301	1	K69	197		301	1	K93
148	41	42	1	S9	198		301	1	K94
149		185	4	S10	199	54	55	1	S9
150		301	1	K70	200		198	4	S10

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S
201		301	1	K95	251	67	68	1	K126
202		301	1	K96	252		211	4	K127
203	55	56	1	S9	253		301	1	K128
204		199	4	S10	254		301	1	K129
205		301	1	K97	255	68	69	1	K130
206		301	1	K98	256		212	4	K131
207	56	57	1	S9	257		301	1	K132
208		200	4	S10	258		301	1	K133
209		301	1	K99	259	69	70	1	K134
210		301	1	K100	260		213	4	S256
211	57	58	1	S9	261		301	1	K135
212		201	4	S10	262		301	1	K136
213		301	1	K101	263	70	71	1	S71
214		301	1	K102	264		214	4	S72
215	58	59	1	S9	265		301	1	K137
216		202	4	S10	266		301	1	K138
217		301	1	K103	267	71	72	1	S71
218		301	1	K104	268		215	4	S72
219	59	60	1	S9	269		301	1	K139
220		203	4	S10	270		301	1	K140
221		301	1	K105	271	72	73	1	S71
222		301	1	K106	272		216	4	S72
223	60	61	1	S9	273		301	1	K141
224		204	4	S10	274		301	1	K142
225		301	1	K107	275	73	74	1	S71
226		301	1	K108	276		217	4	S72
227	61	62	1	S9	277		301	1	S274
228		205	4	S10	278		301	1	K143
229		301	1	K109	279	74	75	1	S71
230		301	1	K110	280		218	4	S72
231	62	63	1	S9	281		301	1	S270
232		206	4	S10	282		301	1	K144
233		301	1	K111	283	75	76	1	S259
234		301	1	K112	284		219	4	S72
235	63	64	1	S9	285		301	1	S266
236		207	4	S10	286		301	1	K145
237		301	1	K113	287	76	77	1	S255
238		301	1	K114	288		220	4	S256
239	64	65	1	K115	289		301	1	S262
240		208	4	S10	290		301	1	K146
241		301	1	K116	291	77	78	1	S251
242		301	1	K117	292		221	4	S256
243	65	66	1	K118	293		301	1	S258
244		209	4	K119	294		301	1	K147
245		301	1	K120	295	78	79	1	S247
246		301	1	K121	296		222	4	S252
247	66	67	1	K122	297		301	1	K148
248		210	4	K123	298		301	1	K149
249		301	1	K124	299	79	80	1	S243
250		301	1	K125	300		223	4	S248

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S
301		301	1	K150	352		236	4	S10
302		301	1	K151	353		301	1	K176
303	80	81	1	S239	354		301	1	K177
304		224	4	S244	355	93	94	1	S9
305		301	1	K152	356		237	4	S10
306		301	1	K153	357		301	1	K178
307	81	82	1	S9	358		301	1	K179
308		225	4	S10	359	94	95	1	S9
309		301	1	K154	360		238	4	S10
310		301	1	K155	361		301	1	K180
311	82	83	1	S9	362		301	1	K181
312		226	4	S10	363	95	96	1	S9
313		301	1	K156	364		239	4	S10
314		301	1	K157	365		301	1	K182
315	83	84	1	S9	366		301	1	K183
316		227	4	S10	367	96	97	1	S67
317		301	1	K158	368		240	4	S10
318		301	1	K159	369		301	1	K184
319	84	85	1	S9	370		301	1	K185
320		228	4	S10	371	97	98	1	S71
321		301	1	K160	372		241	4	S72
322		301	1	K161	373		301	1	K186
323	85	86	1	S9	374		301	1	K187
324		229	4	S10	375	98	99	1	S71
325		301	1	K162	376		242	4	S72
326		301	1	K163	377		301	1	K188
327	86	87	1	S9	378		301	1	K189
328		230	4	S10	379	99	100	1	S71
329		301	1	K164	380		243	4	S72
330		301	1	K165	381		301	1	K190
331	87	88	1	S9	382		301	1	K191
332		231	4	S10	383	100	101	1	S71
333		301	1	K166	384		244	4	S72
334		301	1	K167	385		301	1	K192
335	88	89	1	S9	386	101	102	1	S71
336		232	4	S10	387		245	4	S72
337		301	1	K168	388		301	1	S163
338		301	1	K169	389		301	1	K193
339	89	90	1	S9	390	102	103	1	S67
340		233	4	S10	391		246	4	S72
341		301	1	K170	392		301	1	S159
342		301	1	K171	393		301	1	K194
343	90	91	1	S9	394	103	104	1	S9
344		234	4	S10	395		247	4	S10
345		301	1	K172	396		301	1	K195
346		301	1	K173	397		301	1	K196
347	91	92	1	S9	398	104	105	1	S9
348		235	4	S10	399		248	4	S10
349		301	1	K174	400		301	1	K197
350		301	1	K175	401		301	1	K198
351	92	93	1	S9	402	105	106	1	S9

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S
403		249	4	S10	453		301	1	K224
404		301	1	K199	454	118	119	1	S67
405		301	1	K200	455		262	4	S10
406	106	107	1	S9	456		301	1	K225
407		250	4	S10	457		301	1	K226
408		301	1	K201	458	119	120	1	S71
409		301	1	K202	459		263	4	S72
410	107	108	1	S9	460		301	1	K227
411		251	4	S10	461		301	1	K228
412		301	1	K203	462	120	121	1	S71
413		301	1	K204	463		264	4	S72
414	108	109	1	S9	464		301	1	K229
415		252	4	S10	465		301	1	K230
416		301	1	K205	466	121	122	1	S71
417		301	1	K206	467		265	4	S72
418	109	110	1	S9	468		301	1	K231
419		253	4	S10	469		301	1	K232
420		301	1	K207	470	122	123	1	S71
421		301	1	K208	471		266	4	S72
422	110	111	1	S9	472		301	1	K233
423		254	4	S10	473	123	124	1	S71
424		301	1	K209	474		267	4	S72
425		301	1	K210	475		301	1	K234
426	111	112	1	S9	476	124	125	1	S67
427		255	4	S10	477		268	4	S72
428		301	1	K211	478		301	1	K235
429		301	1	K212	479	125	126	1	S9
430	112	113	1	S9	480		269	4	S10
431		256	4	S10	481		301	1	S22
432		301	1	K213	482		301	1	K236
433		301	1	K214	483	126	127	1	S9
434	113	114	1	S9	484		270	4	S10
435		257	4	S10	485		301	1	S26
436		301	1	K215	486		301	1	K237
437		301	1	K216	487	127	128	1	S9
438	114	115	1	S9	488		271	4	S10
439		258	4	S10	489		301	1	S30
440		301	1	K217	490		301	1	K238
441		301	1	K218	491	128	129	1	S9
442	115	116	1	S9	492		272	4	S10
443		259	4	S10	493		301	1	S34
444		301	1	K219	494		301	1	K239
445		301	1	K220	495	129	130	1	S9
446	116	117	1	S9	496		273	4	S10
447		260	4	S10	497		301	1	S38
448		301	1	K221	498		301	1	K240
449		301	1	K222	499	130	131	1	S9
450	117	118	1	S9	500		274	4	S10
451		261	4	S10	501		301	1	S42
452		301	1	K223	502		301	1	K241

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S
503	131	132	1	S9	553				
504		275	4	S10	554				
505		301	1	S46	555				
506		301	1	K242	556				
507	132	133	1	S9	557				
508		276	4	S10	558				
509		301	1	S42	559				
510		301	1	K243	560				
511	133	134	1	S9	561				
512		277	4	S10	562				
513		301	1	S38	563				
514		301	1	K244	564				
515	134	135	1	S9	565				
516		278	4	S10	566				
517		301	1	S34	567				
518		301	1	K245	568				
519	135	136	1	S9	569				
520		279	4	S10	570				
521		301	1	S30	571				
522		301	1	K246	572				
523	136	137	1	S9	573				
524		280	4	S10	574				
525		301	1	S26	575				
526		301	1	K247	576				
527	137	138	1	S9	577				
528		281	4	S10	578				
529		301	1	S22	579				
530		301	1	K248	580				
531	138	139	1	S9	581				
532		282	4	S10	582				
533		301	1	S18	583				
534		301	1	K249	584				
535	139	140	1	S9	585				
536		283	4	S10	586				
537		301	1	K250	587				
538	140	141	1	S7	588				
539		284	4	S10	589				
540		301	1	K251	590				
541	141	142	1	S1	591				
542		285	4	S2	592				
543	142	143	1	S1	593				
544		286	4	S2	594				
545	143	144	1	S1	595				
546		287	4	S2	596				
547	144	288	4	S2	597				
548					598				
549					599				
550					600				
551					601				
552					602				

BRANCH	NODE	TON	TAG	I, C, S	BRANCH	NODE	TON	TAG	I, C, S.
701	145	302	5	k252	751	195	194	5	S701
702	146	145	5	S701	752	196	195	5	S701
703	147	146	5	S701	753	197	196	5	S701
704	148	147	5	S701	754	198	197	5	S701
705	149	148	5	S701	755	199	198	5	S701
706	150	149	5	S701	756	200	199	5	S701
707	151	150	5	S701	757	201	200	5	S701
708	152	151	5	S701	758	202	201	5	S701
709	153	152	5	S701	759	203	202	5	S701
710	154	153	5	S701	760	204	203	5	S701
711	155	154	5	S701	761	205	204	5	S701
712	156	155	5	S701	762	206	205	5	S701
713	157	156	5	S701	763	207	206	5	S701
714	158	157	5	S701	764	208	207	5	S701
715	159	158	5	S701	765	209	208	5	S701
716	160	159	5	S701	766	210	209	5	S701
717	161	160	5	S701	767	211	210	5	S701
718	162	161	5	S701	768	212	211	5	S701
719	163	162	5	S701	769	213	212	5	S701
720	164	163	5	S701	770	214	213	5	S701
721	165	164	5	S701	771	215	214	5	S701
722	166	165	5	S701	772	216	215	5	S701
723	167	166	5	S701	773	217	216	5	S701
724	168	167	5	S701	774	218	217	5	S701
725	169	168	5	S701	775	219	218	5	S701
726	170	169	5	S701	776	220	219	5	S701
727	171	170	5	S701	777	221	220	5	S701
728	172	171	5	S701	778	222	221	5	S701
729	173	172	5	S701	779	223	222	5	S701
730	174	173	5	S701	780	224	223	5	S701
731	175	174	5	S701	781	225	224	5	S701
732	176	175	5	S701	782	226	225	5	S701
733	177	176	5	S701	783	227	226	5	S701
734	178	177	5	S701	784	228	227	5	S701
735	179	178	5	S701	785	229	228	5	S701
736	180	179	5	S701	786	230	229	5	S701
737	181	180	5	S701	787	231	230	5	S701
738	182	181	5	S701	788	232	231	5	S701
739	183	182	5	S701	789	233	232	5	S701
740	184	183	5	S701	790	234	233	5	S701
741	185	184	5	S701	791	235	234	5	S701
742	186	185	5	S701	792	236	235	5	S701
743	187	186	5	S701	793	237	236	5	S701
744	188	187	5	S701	794	238	237	5	S701
745	189	188	5	S701	795	239	238	5	S701
746	190	189	5	S701	796	240	239	5	S701
747	191	190	5	S701	797	241	240	5	S701
748	192	191	5	S701	798	242	241	5	S701
749	193	192	5	S701	799	243	242	5	S701
750	194	193	5	S701	800	244	243	5	S701

BRANCH	NODE	TON	TAG	I. C. S	BRANCH	NODE	TON	TAG	I. C. S.
801	245	244	5	S701	851				
802	246	245	5	S701	852				
803	247	246	5	S701	853				
804	248	247	5	S701	854				
805	249	248	5	S701	855				
806	250	249	5	S701	856				
807	251	250	5	S701	857				
808	252	251	5	S701	858				
809	253	252	5	S701	859				
810	254	253	5	S701	860				
811	255	254	5	S701	861				
812	256	255	5	S701	862				
813	257	256	5	S701	863				
814	258	257	5	S701	864				
815	259	258	5	S701	865				
816	260	259	5	S701	866				
817	261	260	5	S701	867				
818	262	261	5	S701	868				
819	263	262	5	S701	869				
820	264	263	5	S701	870				
821	265	264	5	S701	871				
822	266	265	5	S701	872				
823	267	266	5	S701	873				
824	268	267	5	S701	874				
825	269	268	5	S701	875				
826	270	269	5	S701	876				
827	271	270	5	S701	877				
828	272	271	5	S701	878				
829	273	272	5	S701	879				
830	274	273	5	S701	880				
831	275	274	5	S701	881				
832	276	275	5	S701	882				
833	277	276	5	S701	883				
834	278	277	5	S701	884				
835	279	278	5	S701	885				
836	280	279	5	S701	886				
837	281	280	5	S701	887				
838	282	281	5	S701	888				
839	283	282	5	S701	889				
840	284	283	5	S701	890				
841	285	284	5	S701	891				
842	286	285	5	S701	892				
843	287	286	5	S701	893				
844	288	287	5	S701	894				
845					895				
846					896				
847					897				
848					898				
849					899				
850					900				

TASS Branch Connection Summary in W/degC or Watts if Tag = 10

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
1	1	2	1	.178E+01	57	17	301	1	.860E-01	113	32	176	4	.701E+00
2	1	145	4	.576E+00	58	17	301	1	.910E-01	114	32	301	1	.860E-01
3	2	3	1	.178E+01	59	18	19	1	.146E+01	115	32	301	1	.830E-01
4	2	146	4	.576E+00	60	18	162	4	.701E+00	116	33	34	1	.146E+01
5	3	4	1	.178E+01	61	18	301	1	.860E-01	117	33	177	4	.701E+00
6	3	147	4	.576E+00	62	18	301	1	.820E-01	118	33	301	1	.860E-01
7	4	5	1	.160E+01	63	19	20	1	.146E+01	119	33	301	1	.830E-01
8	4	148	4	.576E+00	64	19	163	4	.701E+00	120	34	35	1	.146E+01
9	5	6	1	.146E+01	65	19	301	1	.870E-01	121	34	178	4	.701E+00
10	5	149	4	.701E+00	66	19	301	1	.680E-01	122	34	301	1	.860E-01
11	5	301	1	.954E-01	67	20	21	1	.129E+01	123	34	301	1	.830E-01
12	6	7	1	.146E+01	68	20	164	4	.701E+00	124	35	36	1	.146E+01
13	6	150	4	.701E+00	69	20	301	1	.870E-01	125	35	179	4	.701E+00
14	6	301	1	.940E-01	70	20	301	1	.490E-01	126	35	301	1	.860E-01
15	7	8	1	.146E+01	71	21	22	1	.115E+01	127	35	301	1	.820E-01
16	7	151	4	.701E+00	72	21	165	4	.889E+00	128	36	37	1	.146E+01
17	7	301	1	.920E-01	73	21	301	1	.940E-01	129	36	180	4	.701E+00
18	7	301	1	.240E-01	74	22	23	1	.115E+01	130	36	301	1	.860E-01
19	8	9	1	.146E+01	75	22	166	4	.889E+00	131	36	301	1	.810E-01
20	8	152	4	.701E+00	76	22	301	1	.770E-01	132	37	38	1	.146E+01
21	8	301	1	.910E-01	77	23	24	1	.115E+01	133	37	181	4	.701E+00
22	8	301	1	.490E-01	78	23	167	4	.889E+00	134	37	301	1	.850E-01
23	9	10	1	.146E+01	79	23	301	1	.420E-01	135	37	301	1	.800E-01
24	9	153	4	.701E+00	80	24	25	1	.115E+01	136	38	39	1	.146E+01
25	9	301	1	.890E-01	81	24	168	4	.889E+00	137	38	182	4	.701E+00
26	9	301	1	.680E-01	82	24	301	1	.136E+00	138	38	301	1	.850E-01
27	10	11	1	.146E+01	83	24	301	1	.220E-01	139	38	301	1	.780E-01
28	10	154	4	.701E+00	84	25	26	1	.115E+01	140	39	40	1	.146E+01
29	10	301	1	.880E-01	85	25	169	4	.889E+00	141	39	183	4	.701E+00
30	10	301	1	.820E-01	86	25	301	1	.117E+00	142	39	301	1	.850E-01
31	11	12	1	.146E+01	87	25	301	1	.640E-01	143	39	301	1	.770E-01
32	11	155.	4	.701E+00	88	26	27	1	.129E+01	144	40	41	1	.146E+01
33	11	301	1	.870E-01	89	26	170	4	.889E+00	145	40	184	4	.701E+00
34	11	301	1	.910E-01	90	26	301	1	.101E+00	146	40	301	1	.850E-01
35	12	13	1	.146E+01	91	26	301	1	.850E-01	147	40	301	1	.750E-01
36	12	156	4	.701E+00	92	27	28	1	.146E+01	148	41	42	1	.146E+01
37	12	301	1	.860E-01	93	27	171	4	.701E+00	149	41	185	4	.701E+00
38	12	301	1	.970E-01	94	27	301	1	.890E-01	150	41	301	1	.850E-01
39	13	14	1	.146E+01	95	27	301	1	.810E-01	151	41	301	1	.730E-01
40	13	157	4	.701E+00	96	28	29	1	.146E+01	152	42	43	1	.129E+01
41	13	301	1	.850E-01	97	28	172	4	.701E+00	153	42	186	4	.701E+00
42	13	301	1	.100E+00	98	28	301	1	.880E-01	154	42	301	1	.850E-01
43	14	15	1	.146E+01	99	28	301	1	.810E-01	155	42	301	1	.710E-01
44	14	158	4	.701E+00	100	29	30	1	.146E+01	156	43	44	1	.115E+01
45	14	301	1	.850E-01	101	29	173	4	.701E+00	157	43	187	4	.889E+00
46	14	301	1	.101E+00	102	29	301	1	.870E-01	158	43	301	1	.910E-01
47	15	16	1	.146E+01	103	29	301	1	.820E-01	159	43	301	1	.124E+00
48	15	159	4	.701E+00	104	30	31	1	.146E+01	160	44	45	1	.115E+01
49	15	301	1	.850E-01	105	30	174	4	.701E+00	161	44	188	4	.889E+00
50	15	301	1	.100E+00	106	30	301	1	.870E-01	162	44	301	1	.730E-01
51	16	17	1	.146E+01	107	30	301	1	.830E-01	163	44	301	1	.920E-01
52	16	160	4	.701E+00	108	31	32	1	.146E+01	164	45	46	1	.115E+01
53	16	301	1	.850E-01	109	31	175	4	.701E+00	165	45	189	4	.889E+00
54	16	301	1	.970E-01	110	31	301	1	.870E-01	166	45	301	1	.390E-01
55	17	18	1	.146E+01	111	31	301	1	.830E-01	167	46	47	1	.115E+01
56	17	161	4	.701E+00	112	32	33	1	.146E+01	168	46	190	4	.889E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
169	46	301	1	.150E+00	225	60	301	1	.860E-01	281	74	301	1	.138E+00
170	46	301	1	.250E-01	226	60	301	1	.810E-01	282	74	301	1	.700E-01
171	47	48	1	.115E+01	227	61	62	1	.146E+01	283	75	76	1	.120E+01
172	47	191	4	.889E+00	228	61	205	4	.701E+00	284	75	219	4	.889E+00
173	47	301	1	.127E+00	229	61	301	1	.860E-01	285	75	301	1	.157E+00
174	47	301	1	.690E-01	230	61	301	1	.810E-01	286	75	301	1	.900E-01
175	48	49	1	.129E+01	231	62	63	1	.146E+01	287	76	77	1	.125E+01
176	48	192	4	.889E+00	232	62	206	4	.701E+00	288	76	220	4	.655E+00
177	48	301	1	.100E+00	233	62	301	1	.860E-01	289	76	301	1	.171E+00
178	48	301	1	.890E-01	234	62	301	1	.810E-01	290	76	301	1	.980E-01
179	49	50	1	.146E+01	235	63	64	1	.146E+01	291	77	78	1	.210E+01
180	49	193	4	.701E+00	236	63	207	4	.701E+00	292	77	221	4	.655E+00
181	49	301	1	.880E-01	237	63	301	1	.860E-01	293	77	301	1	.172E+00
182	49	301	1	.830E-01	238	63	301	1	.800E-01	294	77	301	1	.970E-01
183	50	51	1	.146E+01	239	64	65	1	.108E+01	295	78	79	1	.172E+01
184	50	194	4	.701E+00	240	64	208	4	.701E+00	296	78	222	4	.542E+00
185	50	301	1	.870E-01	241	64	301	1	.860E-01	297	78	301	1	.124E+00
186	50	301	1	.830E-01	242	64	301	1	.790E-01	298	78	301	1	.910E-01
187	51	52	1	.146E+01	243	65	66	1	.992E+00	299	79	80	1	.992E+00
188	51	195	4	.701E+00	244	65	209	4	.990E+00	300	79	223	4	.815E+00
189	51	301	1	.870E-01	245	65	301	1	.940E-01	301	79	301	1	.108E+00
190	51	301	1	.830E-01	246	65	301	1	.870E-01	302	79	301	1	.870E-01
191	52	53	1	.146E+01	247	66	67	1	.172E+01	303	80	81	1	.108E+01
192	52	196	4	.701E+00	248	66	210	4	.815E+00	304	80	224	4	.990E+00
193	52	301	1	.870E-01	249	66	301	1	.930E-01	305	80	301	1	.930E-01
194	52	301	1	.830E-01	250	66	301	1	.103E+00	306	80	301	1	.910E-01
195	53	54	1	.146E+01	251	67	68	1	.210E+01	307	81	82	1	.146E+01
196	53	197	4	.701E+00	252	67	211	4	.542E+00	308	81	225	4	.701E+00
197	53	301	1	.870E-01	253	67	301	1	.930E-01	309	81	301	1	.840E-01
198	53	301	1	.830E-01	254	67	301	1	.125E+00	310	81	301	1	.830E-01
199	54	55	1	.146E+01	255	68	69	1	.125E+01	311	82	83	1	.146E+01
200	54	198	4	.701E+00	256	68	212	4	.655E+00	312	82	226	4	.701E+00
201	54	301	1	.870E-01	257	68	301	1	.990E-01	313	82	301	1	.850E-01
202	54	301	1	.830E-01	258	68	301	1	.172E+00	314	82	301	1	.820E-01
203	55	56	1	.146E+01	259	69	70	1	.120E+01	315	83	84	1	.146E+01
204	55	199	4	.701E+00	260	69	213	4	.655E+00	316	83	227	4	.701E+00
205	55	301	1	.870E-01	261	69	301	1	.990E-01	317	83	301	1	.850E-01
206	55	301	1	.830E-01	262	69	301	1	.171E+00	318	83	301	1	.820E-01
207	56	57	1	.146E+01	263	70	71	1	.115E+01	319	84	85	1	.146E+01
208	56	200	4	.701E+00	264	70	214	4	.889E+00	320	84	228	4	.701E+00
209	56	301	1	.870E-01	265	70	301	1	.900E-01	321	84	301	1	.860E-01
210	56	301	1	.820E-01	266	70	301	1	.157E+00	322	84	301	1	.820E-01
211	57	58	1	.146E+01	267	71	72	1	.115E+01	323	85	86	1	.146E+01
212	57	201	4	.701E+00	268	71	215	4	.889E+00	324	85	229	4	.701E+00
213	57	301	1	.860E-01	269	71	301	1	.710E-01	325	85	301	1	.860E-01
214	57	301	1	.820E-01	270	71	301	1	.138E+00	326	85	301	1	.820E-01
215	58	59	1	.146E+01	271	72	73	1	.115E+01	327	86	87	1	.146E+01
216	58	202	4	.701E+00	272	72	216	4	.889E+00	328	86	230	4	.701E+00
217	58	301	1	.860E-01	273	72	301	1	.330E-01	329	86	301	1	.860E-01
218	58	301	1	.820E-01	274	72	301	1	.670E-01	330	86	301	1	.820E-01
219	59	60	1	.146E+01	275	73	74	1	.115E+01	331	87	88	1	.146E+01
220	59	203	4	.701E+00	276	73	217	4	.889E+00	332	87	231	4	.701E+00
221	59	301	1	.860E-01	277	73	301	1	.670E-01	333	87	301	1	.860E-01
222	59	301	1	.820E-01	278	73	301	1	.310E-01	334	87	301	1	.820E-01
223	60	61	1	.146E+01	279	74	75	1	.115E+01	335	88	89	1	.146E+01
224	60	204	4	.701E+00	280	74	218	4	.889E+00	336	88	232	4	.701E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
337	88	301	1	.850E-01	393	102	301	1	.900E-01	449	116	301	1	.830E-01
338	88	301	1	.820E-01	394	103	104	1	.146E+01	450	117	118	1	.146E+01
339	89	90	1	.146E+01	395	103	247	4	.701E+00	451	117	261	4	.701E+00
340	89	233	4	.701E+00	396	103	301	1	.760E-01	452	117	301	1	.830E-01
341	89	301	1	.850E-01	397	103	301	1	.840E-01	453	117	301	1	.830E-01
342	89	301	1	.810E-01	398	104	105	1	.146E+01	454	118	119	1	.129E+01
343	90	91	1	.146E+01	399	104	248	4	.701E+00	455	118	262	4	.701E+00
344	90	234	4	.701E+00	400	104	301	1	.780E-01	456	118	301	1	.820E-01
345	90	301	1	.850E-01	401	104	301	1	.840E-01	457	118	301	1	.840E-01
346	90	301	1	.810E-01	402	105	106	1	.146E+01	458	119	120	1	.115E+01
347	91	92	1	.146E+01	403	105	249	4	.701E+00	459	119	263	4	.889E+00
348	91	235	4	.701E+00	404	105	301	1	.790E-01	460	119	301	1	.860E-01
349	91	301	1	.850E-01	405	105	301	1	.830E-01	461	119	301	1	.960E-01
350	91	301	1	.810E-01	406	106	107	1	.146E+01	462	120	121	1	.115E+01
351	92	93	1	.146E+01	407	106	250	4	.701E+00	463	120	264	4	.889E+00
352	92	236	4	.701E+00	408	106	301	1	.810E-01	464	120	301	1	.650E-01
353	92	301	1	.850E-01	409	106	301	1	.830E-01	465	120	301	1	.113E+00
354	92	301	1	.810E-01	410	107	108	1	.146E+01	466	121	122	1	.115E+01
355	93	94	1	.146E+01	411	107	251	4	.701E+00	467	121	265	4	.889E+00
356	93	237	4	.701E+00	412	107	301	1	.820E-01	468	121	301	1	.220E-01
357	93	301	1	.850E-01	413	107	301	1	.830E-01	469	121	301	1	.133E+00
358	93	301	1	.810E-01	414	108	109	1	.146E+01	470	122	123	1	.115E+01
359	94	95	1	.146E+01	415	108	252	4	.701E+00	471	122	266	4	.889E+00
360	94	238	4	.701E+00	416	108	301	1	.840E-01	472	122	301	1	.420E-01
361	94	301	1	.850E-01	417	108	301	1	.830E-01	473	123	124	1	.115E+01
362	94	301	1	.810E-01	418	109	110	1	.146E+01	474	123	267	4	.889E+00
363	95	96	1	.146E+01	419	109	253	4	.701E+00	475	123	301	1	.760E-01
364	95	239	4	.701E+00	420	109	301	1	.850E-01	476	124	125	1	.129E+01
365	95	301	1	.850E-01	421	109	301	1	.830E-01	477	124	268	4	.889E+00
366	95	301	1	.810E-01	422	110	111	1	.146E+01	478	124	301	1	.940E-01
367	96	97	1	.129E+01	423	110	254	4	.701E+00	479	125	126	1	.146E+01
368	96	240	4	.701E+00	424	110	301	1	.850E-01	480	125	269	4	.701E+00
369	96	301	1	.840E-01	425	110	301	1	.830E-01	481	125	301	1	.490E-01
370	96	301	1	.800E-01	426	111	112	1	.146E+01	482	125	301	1	.860E-01
371	97	98	1	.115E+01	427	111	255	4	.701E+00	483	126	127	1	.146E+01
372	97	241	4	.889E+00	428	111	301	1	.850E-01	484	126	270	4	.701E+00
373	97	301	1	.900E-01	429	111	301	1	.830E-01	485	126	301	1	.680E-01
374	97	301	1	.930E-01	430	112	113	1	.146E+01	486	126	301	1	.860E-01
375	98	99	1	.115E+01	431	112	256	4	.701E+00	487	127	128	1	.146E+01
376	98	242	4	.889E+00	432	112	301	1	.850E-01	488	127	271	4	.701E+00
377	98	301	1	.690E-01	433	112	301	1	.830E-01	489	127	301	1	.820E-01
378	98	301	1	.123E+00	434	113	114	1	.146E+01	490	127	301	1	.850E-01
379	99	100	1	.115E+01	435	113	257	4	.701E+00	491	128	129	1	.146E+01
380	99	243	4	.889E+00	436	113	301	1	.850E-01	492	128	272	4	.701E+00
381	99	301	1	.260E-01	437	113	301	1	.830E-01	493	128	301	1	.910E-01
382	99	301	1	.149E+00	438	114	115	1	.146E+01	494	128	301	1	.840E-01
383	100	101	1	.115E+01	439	114	258	4	.701E+00	495	129	130	1	.146E+01
384	100	244	4	.889E+00	440	114	301	1	.850E-01	496	129	273	4	.701E+00
385	100	301	1	.380E-01	441	114	301	1	.830E-01	497	129	301	1	.970E-01
386	101	102	1	.115E+01	442	115	116	1	.146E+01	498	129	301	1	.830E-01
387	101	245	4	.889E+00	443	115	259	4	.701E+00	499	130	131	1	.146E+01
388	101	301	1	.920E-01	444	115	301	1	.840E-01	500	130	274	4	.701E+00
389	101	301	1	.720E-01	445	115	301	1	.830E-01	501	130	301	1	.100E+00
390	102	103	1	.129E+01	446	116	117	1	.146E+01	502	130	301	1	.830E-01
391	102	246	4	.889E+00	447	116	260	4	.701E+00	503	131	132	1	.146E+01
392	102	301	1	.124E+00	448	116	301	1	.840E-01	504	131	275	4	.701E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
505	131	301	1	.101E+00	561	158	157	5	.174E+03	617	214	213	5	.174E+03
506	131	301	1	.830E-01	562	159	158	5	.174E+03	618	215	214	5	.174E+03
507	132	133	1	.146E+01	563	160	159	5	.174E+03	619	216	215	5	.174E+03
508	132	276	4	.701E+00	564	161	160	5	.174E+03	620	217	216	5	.174E+03
509	132	301	1	.100E+00	565	162	161	5	.174E+03	621	218	217	5	.174E+03
510	132	301	1	.830E-01	566	163	162	5	.174E+03	622	219	218	5	.174E+03
511	133	134	1	.146E+01	567	164	163	5	.174E+03	623	220	219	5	.174E+03
512	133	277	4	.701E+00	568	165	164	5	.174E+03	624	221	220	5	.174E+03
513	133	301	1	.970E-01	569	166	165	5	.174E+03	625	222	221	5	.174E+03
514	133	301	1	.830E-01	570	167	166	5	.174E+03	626	223	222	5	.174E+03
515	134	135	1	.146E+01	571	168	167	5	.174E+03	627	224	223	5	.174E+03
516	134	278	4	.701E+00	572	169	168	5	.174E+03	628	225	224	5	.174E+03
517	134	301	1	.910E-01	573	170	169	5	.174E+03	629	226	225	5	.174E+03
518	134	301	1	.840E-01	574	171	170	5	.174E+03	630	227	226	5	.174E+03
519	135	136	1	.146E+01	575	172	171	5	.174E+03	631	228	227	5	.174E+03
520	135	279	4	.701E+00	576	173	172	5	.174E+03	632	229	228	5	.174E+03
521	135	301	1	.820E-01	577	174	173	5	.174E+03	633	230	229	5	.174E+03
522	135	301	1	.840E-01	578	175	174	5	.174E+03	634	231	230	5	.174E+03
523	136	137	1	.146E+01	579	176	175	5	.174E+03	635	232	231	5	.174E+03
524	136	280	4	.701E+00	580	177	176	5	.174E+03	636	233	232	5	.174E+03
525	136	301	1	.680E-01	581	178	177	5	.174E+03	637	234	233	5	.174E+03
526	136	301	1	.860E-01	582	179	178	5	.174E+03	638	235	234	5	.174E+03
527	137	138	1	.146E+01	583	180	179	5	.174E+03	639	236	235	5	.174E+03
528	137	281	4	.701E+00	584	181	180	5	.174E+03	640	237	236	5	.174E+03
529	137	301	1	.490E-01	585	182	181	5	.174E+03	641	238	237	5	.174E+03
530	137	301	1	.870E-01	586	183	182	5	.174E+03	642	239	238	5	.174E+03
531	138	139	1	.146E+01	587	184	183	5	.174E+03	643	240	239	5	.174E+03
532	138	282	4	.701E+00	588	185	184	5	.174E+03	644	241	240	5	.174E+03
533	138	301	1	.240E-01	589	186	185	5	.174E+03	645	242	241	5	.174E+03
534	138	301	1	.880E-01	590	187	186	5	.174E+03	646	243	242	5	.174E+03
535	139	140	1	.146E+01	591	188	187	5	.174E+03	647	244	243	5	.174E+03
536	139	283	4	.701E+00	592	189	188	5	.174E+03	648	245	244	5	.174E+03
537	139	301	1	.900E-01	593	190	189	5	.174E+03	649	246	245	5	.174E+03
538	140	141	1	.160E+01	594	191	190	5	.174E+03	650	247	246	5	.174E+03
539	140	284	4	.701E+00	595	192	191	5	.174E+03	651	248	247	5	.174E+03
540	140	301	1	.910E-01	596	193	192	5	.174E+03	652	249	248	5	.174E+03
541	141	142	1	.178E+01	597	194	193	5	.174E+03	653	250	249	5	.174E+03
542	141	285	4	.576E+00	598	195	194	5	.174E+03	654	251	250	5	.174E+03
543	142	143	1	.178E+01	599	196	195	5	.174E+03	655	252	251	5	.174E+03
544	142	286	4	.576E+00	600	197	196	5	.174E+03	656	253	252	5	.174E+03
545	143	144	1	.178E+01	601	198	197	5	.174E+03	657	254	253	5	.174E+03
546	143	287	4	.576E+00	602	199	198	5	.174E+03	658	255	254	5	.174E+03
547	144	288	4	.576E+00	603	200	199	5	.174E+03	659	256	255	5	.174E+03
548	145	302	5	.174E+03	604	201	200	5	.174E+03	660	257	256	5	.174E+03
549	146	145	5	.174E+03	605	202	201	5	.174E+03	661	258	257	5	.174E+03
550	147	146	5	.174E+03	606	203	202	5	.174E+03	662	259	258	5	.174E+03
551	148	147	5	.174E+03	607	204	203	5	.174E+03	663	260	259	5	.174E+03
552	149	148	5	.174E+03	608	205	204	5	.174E+03	664	261	260	5	.174E+03
553	150	149	5	.174E+03	609	206	205	5	.174E+03	665	262	261	5	.174E+03
554	151	150	5	.174E+03	610	207	206	5	.174E+03	666	263	262	5	.174E+03
555	152	151	5	.174E+03	611	208	207	5	.174E+03	667	264	263	5	.174E+03
556	153	152	5	.174E+03	612	209	208	5	.174E+03	668	265	264	5	.174E+03
557	154	153	5	.174E+03	613	210	209	5	.174E+03	669	266	265	5	.174E+03
558	155	154	5	.174E+03	614	211	210	5	.174E+03	670	267	266	5	.174E+03
559	156	155	5	.174E+03	615	212	211	5	.174E+03	671	268	267	5	.174E+03
560	157	156	5	.174E+03	616	213	212	5	.174E+03	672	269	268	5	.174E+03

Brnh	From	To	Tag	Conduct
673	270	269	5	.174E+03
674	271	270	5	.174E+03
675	272	271	5	.174E+03
676	273	272	5	.174E+03
677	274	273	5	.174E+03
678	275	274	5	.174E+03
679	276	275	5	.174E+03
680	277	276	5	.174E+03
681	278	277	5	.174E+03
682	279	278	5	.174E+03
683	280	279	5	.174E+03
684	281	280	5	.174E+03
685	282	281	5	.174E+03
686	283	282	5	.174E+03
687	284	283	5	.174E+03
688	285	284	5	.174E+03
689	286	285	5	.174E+03
690	287	286	5	.174E+03
691	288	287	5	.174E+03

TASS GENERAL INPUT MENU - SI Units

(1) Case Title:
TALSR(METRIC)---RUN 3. COMPLEX MODEL, MASS FLOW OF 68 kg/hr (150 lbm/hr)

(2) Nodes	288
(3) Constant Temperatures	2
(4) Unique Exponents	0
(5) Temperature Dependent Conductances	0
(6) Temperature Dependent Heat Inputs	0
(7) Computational Accuracy	.0100
(8) Starting Temperature	25.0

Are these inputs correct (Y/N) ? Y

INPUT DATA

Fin Length (L) (cm)	Fin Thickness (cm)	Fin spacing (z) (cm)	Thermal Conductivity of Copper (k) (W/cm-K)	Reynolds Number	Prandtl Number	Outer pipe diameter (cm)	Inner pipe diameter (cm)	Pipe Area (sq cm)
0.318	0.015	0.0533	4.01	1900.00	0.707	0.635	0.483	0.134

K-Value	Channel Width (b) (cm)	Effective Diameter (cm)	Heat Transfer Coefficient (h) (W/sqcm-K)	b-Term (cm)	Yin.f (W/K)	Dist. between Nodes (cm)	Fins/node	K - Value (W/K)
K1			N/A			0.302	N/A	1.7784
K2			0.670			0.302	N/A	0.3064
K3			N/A			0.334	N/A	1.6043
K4			N/A			0.367	N/A	1.4612
K5			0.670			0.367	N/A	0.3729
K6	1.143	0.1019	0.03626	0.68200	0.01333	0.367	6.880	0.0954
K7	1.143	0.1019	0.03626	0.66800	0.01314	0.367	6.880	0.0940
K8	1.143	0.1019	0.03626	0.65200	0.01291	0.367	6.880	0.0924
K9	0.094	0.0681	0.04748		0.00282	0.367	6.880	0.0241
K10	1.143	0.1019	0.03626	0.63500	0.01266	0.367	6.880	0.0907
K11	0.269	0.0890	0.03967		0.00658	0.367	6.880	0.0492
K12	1.143	0.1019	0.03626	0.62100	0.01245	0.367	6.880	0.0893
K13	0.414	0.0945	0.03813		0.00937	0.367	6.880	0.0682
K14	1.143	0.1019	0.03626	0.60800	0.01226	0.367	6.880	0.0879
K15	0.531	0.0969	0.03749		0.01136	0.367	6.880	0.0819
K16	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K17	0.620	0.0982	0.03716		0.01271	0.367	6.880	0.0911
K18	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K19	0.681	0.0989	0.03698		0.01354	0.367	6.880	0.0969
K20	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K21	0.716	0.0993	0.03690		0.01400	0.367	6.880	0.1000
K22	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K23	0.732	0.0994	0.03686		0.01419	0.367	6.880	0.1013
K24	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K25	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K26	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K27	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K28	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
K29			N/A			0.416	N/A	1.2907
K30	1.143	0.1019	0.03626	0.60200	0.01216	0.367	6.880	0.0873
K31			N/A			0.465	N/A	1.1524
K32			0.670			0.465	N/A	0.4728
K33	1.104	0.1018	0.03629	0.59000	0.01199	0.465	7.540	0.0944
K34	0.808	0.1001	0.03670	0.44800	0.00968	0.465	7.540	0.0770
K35	0.296	0.0904	0.03928	0.20300	0.00498	0.465	7.540	0.0419
K36	2.037	0.1040	0.03578	1.10100	0.01745	0.465	7.540	0.1355
K37	0.296	0.0904	0.03928	0.09300	0.00231	0.465	7.540	0.0218
K38	1.496	0.1030	0.03600	0.62200	0.01501	0.465	7.540	0.1171
K39	0.808	0.1001	0.03670	0.36000	0.00798	0.465	7.540	0.0642
K40	1.184	0.1021	0.03622	0.65100	0.01288	0.465	7.540	0.1012
K41	1.104	0.1018	0.03629	0.51400	0.01075	0.465	7.540	0.0850

K42	1.143	0.1019	0.03626	0.61800	0.01241	0.367	6.880	0.0890
K43	1.143	0.1019	0.03626	0.54100	0.01119	0.367	6.880	0.0806
K44	1.143	0.1019	0.03626	0.61000	0.01229	0.367	6.880	0.0861
K45	1.143	0.1019	0.03626	0.64700	0.01129	0.367	6.880	0.0813
K46	1.143	0.1019	0.03626	0.60300	0.01218	0.367	6.880	0.0874
K47	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K48	1.143	0.1019	0.03626	0.59600	0.01210	0.367	6.880	0.0869
K49	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K50	1.143	0.1019	0.03626	0.59500	0.01206	0.367	6.880	0.0866
K51	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K52	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K53	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K54	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K55	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K56	1.143	0.1019	0.03626	0.58900	0.01193	0.367	6.880	0.0859
K57	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K58	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K59	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K60	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K61	1.143	0.1019	0.03626	0.54500	0.01128	0.367	6.880	0.0810
K62	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K63	1.143	0.1019	0.03626	0.53500	0.01109	0.367	6.880	0.0799
K64	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K65	1.143	0.1019	0.03626	0.52200	0.01087	0.367	6.880	0.0784
K66	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K67	1.143	0.1019	0.03626	0.50800	0.01063	0.367	6.880	0.0768
K68	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K69	1.143	0.1019	0.03626	0.49100	0.01034	0.367	6.880	0.0747
K70	1.143	0.1019	0.03626	0.57800	0.01179	0.367	6.880	0.0847
K71	1.143	0.1019	0.03626	0.47500	0.01005	0.367	6.880	0.0728
K72	1.143	0.1019	0.03626	0.57800	0.01179	0.367	6.880	0.0847
K73	1.143	0.1019	0.03626	0.46100	0.00980	0.367	6.880	0.0711
K74	1.104	0.1018	0.03629	0.65000	0.01150	0.465	7.540	0.0907
K75	0.888	0.1006	0.03657		0.01591	0.465	7.540	0.1240
K76	0.808	0.1001	0.03670	0.41800	0.00911	0.465	7.540	0.0728
K77	0.550	0.0973	0.03741		0.01167	0.465	7.540	0.0921
K78	0.296	0.0904	0.03926	0.18500	0.00455	0.465	7.540	0.0386
K79	2.931	0.1048	0.03560	1.48800	0.01932	0.465	7.540	0.1490
K80	0.200	0.0904	0.03928	0.11100	0.00276	0.465	7.540	0.0251
K81	1.650	0.1037	0.03584	0.95000	0.01625	0.465	7.540	0.1265
K82	0.808	0.1001	0.03670	0.39000	0.00857	0.465	7.540	0.0687
K83	1.225	0.1022	0.03618	0.64500	0.01279	0.465	7.540	0.1004
K84	1.104	0.1018	0.03629	0.64500	0.01127	0.465	7.540	0.0890
K85	1.143	0.1019	0.03626	0.60400	0.01220	0.367	6.880	0.0875
K86	1.143	0.1019	0.03626	0.56500	0.01158	0.367	6.880	0.0833
K87	1.143	0.1019	0.03626	0.60300	0.01216	0.367	6.880	0.0874
K88	1.143	0.1019	0.03626	0.56500	0.01168	0.367	6.880	0.0833
K89	1.143	0.1019	0.03626	0.60200	0.01216	0.367	6.880	0.0873
K90	1.143	0.1019	0.03626	0.56300	0.01165	0.367	6.880	0.0831
K91	1.143	0.1019	0.03626	0.60000	0.01213	0.367	6.880	0.0871
K92	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K93	1.143	0.1019	0.03626	0.59600	0.01212	0.367	6.880	0.0870

K94	1.143	0.1019	0.03626	0.56100	0.01162	0.367	6.880	0.0828
K95	1.143	0.1019	0.03626	0.59600	0.01210	0.367	6.880	0.0869
K96	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K97	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
K98	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K99	1.143	0.1019	0.03626	0.59500	0.01206	0.367	6.880	0.0866
K100	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K101	1.143	0.1019	0.03626	0.59400	0.01204	0.367	6.880	0.0864
K102	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K103	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K104	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K105	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K106	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K107	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K108	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K109	1.143	0.1019	0.03626	0.58900	0.01196	0.367	6.880	0.0858
K110	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K111	1.143	0.1019	0.03626	0.58700	0.01193	0.367	6.880	0.0857
K112	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K113	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K114	1.143	0.1019	0.03626	0.53300	0.01106	0.367	6.880	0.0797
K115			N/A			0.496	N/A	1.0819
K116	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K117	1.143	0.1019	0.03626	0.62500	0.01092	0.367	6.880	0.0788
K118			N/A			0.541	N/A	0.962
K119			0.670			0.518	N/A	0.526
K120	1.143	0.1019	0.03626	0.58300	0.01187	0.541	7.540	0.0935
K121	1.184	0.1021	0.03622	0.63400	0.01106	0.541	7.540	0.0874
K122			N/A			0.312	N/A	1.717
K123			0.670			0.427	N/A	0.433
K124	1.143	0.1019	0.03626	0.58100	0.01184	0.312	7.540	0.0933
K125	1.496	0.1030	0.03600	0.67400	0.01314	0.312	7.540	0.1031
K126			N/A			0.255	N/A	2.100
K127			0.670			0.284	N/A	0.288
K128	1.143	0.1019	0.03626	0.58000	0.01182	0.255	7.540	0.0931
K129	2.037	0.1040	0.03578	0.93600	0.01610	0.255	7.540	0.1254
K130			N/A			0.429	N/A	1.251
K131			0.670			0.343	N/A	0.348
K132	1.143	0.1019	0.03626	0.67900	0.01181	0.429	8.040	0.0992
K133	2.907	0.10476	0.03560		0.02086	0.429	8.040	0.1720
K134			N/A			0.447	N/A	1.200
K135	1.143	0.1019	0.03628	0.57600	0.01176	0.429	8.040	0.0989
K136	2.482	0.10444	0.03567		0.02077	0.429	8.040	0.1712
K137	1.104	0.1018	0.03629	0.55500	0.01143	0.465	7.540	0.0902
K138	1.840	0.10368	0.03585		0.02025	0.465	7.540	0.1567
K139	0.808	0.1001	0.03670	0.40700	0.00890	0.465	7.540	0.0712
K140	1.119	0.10182	0.03628		0.01775	0.465	7.540	0.1378
K141	0.296	0.0904	0.03928	0.15100	0.00373	0.465	7.540	0.0325
K142	0.359	0.09288	0.03857		0.00834	0.465	7.540	0.0672
K143	0.296	0.0904	0.03928	0.14500	0.00358	0.465	7.540	0.0314
K144	0.808	0.1001	0.03670	0.40100	0.00879	0.465	7.540	0.0703
K145	1.104	0.1018	0.03629	0.64900	0.01133	0.465	7.540	0.0895

K146	1.143	0.1019	0.03626	0.56700	0.01161	0.429	8.040	0.0977
K147	1.143	0.1019	0.03626	0.56400	0.01157	0.429	8.040	0.0973
K148	2.037	0.1040	0.03578	0.97600	0.01647	0.255	7.540	0.1242
K149	1.143	0.1019	0.03626	0.56300	0.01155	0.255	7.540	0.0911
K150	1.496	0.1030	0.03600	0.71900	0.01375	0.312	7.540	0.1077
K151	1.143	0.1019	0.03626	0.56200	0.01153	0.312	7.540	0.0870
K152	1.184	0.1021	0.03622	0.58200	0.01184	0.541	7.540	0.0933
K153	1.143	0.1019	0.03626	0.56000	0.01150	0.541	7.540	0.0907
K154	1.143	0.1019	0.03626	0.57300	0.01171	0.367	6.880	0.0842
K155	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K156	1.143	0.1019	0.03626	0.57900	0.01181	0.367	6.880	0.0848
K157	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K158	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K159	1.143	0.1019	0.03626	0.55600	0.01144	0.367	6.880	0.0823
K160	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K161	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K162	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K163	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K164	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K165	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K166	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K167	1.143	0.1019	0.03626	0.55000	0.01134	0.367	6.880	0.0816
K168	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K169	1.143	0.1019	0.03626	0.54900	0.01132	0.367	6.880	0.0815
K170	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K171	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K172	1.143	0.1019	0.03626	0.58300	0.01187	0.367	6.880	0.0853
K173	1.143	0.1019	0.03626	0.54700	0.01129	0.367	6.880	0.0813
K174	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K175	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K176	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K177	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.880	0.0809
K178	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K179	1.143	0.1019	0.03626	0.54300	0.01122	0.367	6.880	0.0808
K180	1.143	0.1019	0.03626	0.57700	0.01177	0.367	6.880	0.0846
K181	1.143	0.1019	0.03626	0.54100	0.01119	0.367	6.880	0.0806
K182	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K183	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K184	1.143	0.1019	0.03626	0.57500	0.01174	0.367	6.880	0.0844
K185	1.143	0.1019	0.03626	0.53900	0.01116	0.367	6.880	0.0804
K186	1.104	0.1018	0.03629	0.55300	0.01140	0.465	7.540	0.0900
K187	1.225	0.1022	0.03618	0.58000	0.01180	0.465	7.540	0.0930
K188	0.808	0.1001	0.03670	0.39500	0.00867	0.465	7.540	0.0694
K189	1.850	0.1037	0.03584	0.89900	0.01577	0.465	7.540	0.1229
K190	0.296	0.0904	0.03928	0.11600	0.00288	0.465	7.540	0.0260
K191	2.931	0.1048	0.03560	1.44400	0.01917	0.465	7.540	0.1485
K192	0.296	0.0904	0.03928	0.18000	0.00443	0.465	7.540	0.0377
K193	0.808	0.1001	0.03670	0.41300	0.00902	0.465	7.540	0.0721
K194	1.104	0.1018	0.03629	0.55100	0.01136	0.465	7.540	0.0897
K195	1.143	0.1019	0.03626	0.50400	0.01056	0.367	6.880	0.0763
K196	1.143	0.1019	0.03626	0.56800	0.01163	0.367	6.880	0.0836
K197	1.143	0.1019	0.03626	0.51700	0.01079	0.367	6.880	0.0778

K198	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K199	1.143	0.1019	0.03626	0.53100	0.01102	0.367	6.880	0.0794
K200	1.143	0.1019	0.03626	0.56600	0.01160	0.367	6.880	0.0834
K201	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.880	0.0809
K202	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K203	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K204	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K205	1.143	0.1019	0.03626	0.56800	0.01163	0.367	6.880	0.0836
K206	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K207	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K208	1.143	0.1019	0.03626	0.56000	0.01150	0.367	6.880	0.0827
K209	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K210	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K211	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K212	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K213	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K214	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K215	1.143	0.1019	0.03626	0.58300	0.01187	0.367	6.880	0.0853
K216	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K217	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K218	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0826
K219	1.143	0.1019	0.03626	0.57400	0.01173	0.367	6.880	0.0843
K220	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K221	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K222	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K223	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K224	1.143	0.1019	0.03626	0.56400	0.01157	0.367	6.880	0.0832
K225	1.143	0.1019	0.03626	0.55000	0.01134	0.367	6.880	0.0816
K226	1.143	0.1019	0.03626	0.57000	0.01166	0.367	6.880	0.0838
K227	1.104	0.1018	0.03629	0.62200	0.01088	0.465	7.540	0.0861
K228	1.184	0.1021	0.03622	0.60200	0.01215	0.465	7.540	0.0956
K229	0.808	0.1001	0.03670	0.36500	0.00808	0.465	7.540	0.0650
K230	1.496	0.1030	0.03600	0.77800	0.01449	0.465	7.540	0.1133
K231	0.298	0.0904	0.03928	0.09400	0.00234	0.465	7.540	0.0220
K232	2.037	0.1040	0.03578	1.08100	0.01716	0.465	7.540	0.1333
K233	0.298	0.0904	0.03928	0.20200	0.00495	0.465	7.540	0.0417
K234	0.808	0.1001	0.03670	0.44300	0.00958	0.465	7.540	0.0763
K235	1.104	0.1018	0.03629	0.58200	0.01186	0.465	7.540	0.0935
K236	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K237	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K238	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K239	1.143	0.1019	0.03626	0.56900	0.01165	0.367	6.880	0.0837
K240	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K241	1.143	0.1019	0.03626	0.56000	0.01150	0.367	6.880	0.0827
K242	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K243	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K244	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K245	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K246	1.143	0.1019	0.03626	0.57600	0.01174	0.367	6.880	0.0844
K247	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K248	1.143	0.1019	0.03626	0.59900	0.01212	0.367	6.880	0.0870
K249	1.143	0.1019	0.03626	0.61200	0.01232	0.367	6.880	0.0884

K250	1.143	0.1019	0.03626	0.62600	0.01253	0.367	6.880	0.0898
K251	1.143	0.1019	0.03626	0.63900	0.01272	0.367	6.880	0.0911
K252	N/A	N/A	N/A	N/A	N/A	N/A	N/A	79.0400

TASS Branch Connection Summary in W/degC or Watts if Tag = 10

Brnh	From	To	Tag	Conduct
1	1	2	1	.178E+01
2	1	145	4	.306E+00
3	2	3	1	.178E+01
4	2	146	4	.306E+00
5	3	4	1	.178E+01
6	3	147	4	.306E+00
7	4	5	1	.160E+01
8	4	148	4	.306E+00
9	5	6	1	.146E+01
10	5	149	4	.373E+00
11	5	301	1	.954E-01
12	6	7	1	.146E+01
13	6	150	4	.373E+00
14	6	301	1	.940E-01
15	7	8	1	.146E+01
16	7	151	4	.373E+00
17	7	301	1	.920E-01
18	7	301	1	.240E-01
19	8	9	1	.146E+01
20	8	152	4	.373E+00
21	8	301	1	.910E-01
22	8	301	1	.490E-01
23	9	10	1	.146E+01
24	9	153	4	.373E+00
25	9	301	1	.890E-01
26	9	301	1	.680E-01
27	10	11	1	.146E+01
28	10	154	4	.373E+00
29	10	301	1	.880E-01
30	10	301	1	.820E-01
31	11	12	1	.146E+01
32	11	155	4	.373E+00
33	11	301	1	.870E-01
34	11	301	1	.910E-01
35	12	13	1	.146E+01
36	12	156	4	.373E+00
37	12	301	1	.860E-01
38	12	301	1	.970E-01
39	13	14	1	.146E+01
40	13	157	4	.373E+00
41	13	301	1	.850E-01
42	13	301	1	.100E+00
43	14	15	1	.146E+01
44	14	158	4	.373E+00
45	14	301	1	.850E-01
46	14	301	1	.101E+00
47	15	16	1	.146E+01
48	15	159	4	.373E+00
49	15	301	1	.850E-01
50	15	301	1	.100E+00
51	16	17	1	.146E+01
52	16	160	4	.373E+00
53	16	301	1	.850E-01
54	16	301	1	.970E-01
55	17	18	1	.146E+01
56	17	161	4	.373E+00
57	17	301	1	.860E-01
58	17	301	1	.910E-01
59	18	19	1	.146E+01
60	18	162	4	.373E+00
61	18	301	1	.860E-01
62	18	301	1	.820E-01
63	19	20	1	.146E+01
64	19	163	4	.373E+00
65	19	301	1	.870E-01
66	19	301	1	.680E-01
67	20	21	1	.129E+01
68	20	164	4	.373E+00
69	20	301	1	.870E-01
70	20	301	1	.490E-01
71	21	22	1	.115E+01
72	21	165	4	.473E+00
73	21	301	1	.940E-01
74	22	23	1	.115E+01
75	22	166	4	.473E+00
76	22	301	1	.770E-01
77	23	24	1	.115E+01
78	23	167	4	.473E+00
79	23	301	1	.420E-01
80	24	25	1	.115E+01
81	24	168	4	.473E+00
82	24	301	1	.136E+00
83	24	301	1	.220E-01
84	25	26	1	.115E+01
85	25	169	4	.473E+00
86	25	301	1	.117E+00
87	25	301	1	.640E-01
88	26	27	1	.129E+01
89	26	170	4	.473E+00
90	26	301	1	.101E+00
91	26	301	1	.850E-01
92	27	28	1	.146E+01
93	27	171	4	.373E+00
94	27	301	1	.890E-01
95	27	301	1	.810E-01
96	28	29	1	.146E+01
97	28	172	4	.373E+00
98	28	301	1	.880E-01
99	28	301	1	.810E-01
100	29	30	1	.146E+01
101	29	173	4	.373E+00
102	29	301	1	.870E-01
103	29	301	1	.820E-01
104	30	31	1	.146E+01
105	30	174	4	.373E+00
106	30	301	1	.870E-01
107	30	301	1	.830E-01
108	31	32	1	.146E+01
109	31	175	4	.373E+00
110	31	301	1	.870E-01
111	31	301	1	.830E-01
112	32	33	1	.146E+01
113	32	176	4	.373E+00
114	32	301	1	.860E-01
115	32	301	1	.830E-01
116	33	34	1	.146E+01
117	33	177	4	.373E+00
118	33	301	1	.860E-01
119	33	301	1	.830E-01
120	34	35	1	.146E+01
121	34	178	4	.373E+00
122	34	301	1	.860E-01
123	34	301	1	.830E-01
124	35	36	1	.146E+01
125	35	179	4	.373E+00
126	35	301	1	.860E-01
127	35	301	1	.820E-01
128	36	37	1	.146E+01
129	36	180	4	.373E+00
130	36	301	1	.860E-01
131	36	301	1	.810E-01
132	37	38	1	.146E+01
133	37	181	4	.373E+00
134	37	301	1	.850E-01
135	37	301	1	.800E-01
136	38	39	1	.146E+01
137	38	182	4	.373E+00
138	38	301	1	.850E-01
139	38	301	1	.780E-01
140	39	40	1	.146E+01
141	39	183	4	.373E+00
142	39	301	1	.850E-01
143	39	301	1	.770E-01
144	40	41	1	.146E+01
145	40	184	4	.373E+00
146	40	301	1	.850E-01
147	40	301	1	.750E-01
148	41	42	1	.146E+01
149	41	185	4	.373E+00
150	41	301	1	.850E-01
151	41	301	1	.730E-01
152	42	43	1	.129E+01
153	42	186	4	.373E+00
154	42	301	1	.850E-01
155	42	301	1	.710E-01
156	43	44	1	.115E+01
157	43	187	4	.473E+00
158	43	301	1	.910E-01
159	43	301	1	.124E+00
160	44	45	1	.115E+01
161	44	188	4	.473E+00
162	44	301	1	.730E-01
163	44	301	1	.920E-01
164	45	46	1	.115E+01
165	45	189	4	.473E+00
166	45	301	1	.390E-01
167	46	47	1	.115E+01
168	46	190	4	.473E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
169	46	301	1	.150E+00	225	60	301	1	.860E-01	281	74	301	1	.138E+00
170	46	301	1	.250E-01	226	60	301	1	.810E-01	282	74	301	1	.700E-01
171	47	48	1	.115E+01	227	61	62	1	.146E+01	283	75	76	1	.120E+01
172	47	191	4	.473E+00	228	61	205	4	.373E+00	284	75	219	4	.473E+00
173	47	301	1	.127E+00	229	61	301	1	.860E-01	285	75	301	1	.157E+00
174	47	301	1	.690E-01	230	61	301	1	.810E-01	286	75	301	1	.900E-01
175	48	49	1	.129E+01	231	62	63	1	.146E+01	287	76	77	1	.125E+01
176	48	192	4	.473E+00	232	62	206	4	.373E+00	288	76	220	4	.348E+00
177	48	301	1	.100E+00	233	62	301	1	.860E-01	289	76	301	1	.171E+00
178	48	301	1	.890E-01	234	62	301	1	.810E-01	290	76	301	1	.980E-01
179	49	50	1	.146E+01	235	63	64	1	.146E+01	291	77	78	1	.210E+01
180	49	193	4	.373E+00	236	63	207	4	.373E+00	292	77	221	4	.348E+00
181	49	301	1	.880E-01	237	63	301	1	.860E-01	293	77	301	1	.172E+00
182	49	301	1	.830E-01	238	63	301	1	.800E-01	294	77	301	1	.970E-01
183	50	51	1	.146E+01	239	64	65	1	.108E+01	295	78	79	1	.172E+01
184	50	194	4	.373E+00	240	64	208	4	.373E+00	296	78	222	4	.288E+00
185	50	301	1	.870E-01	241	64	301	1	.860E-01	297	78	301	1	.124E+00
186	50	301	1	.830E-01	242	64	301	1	.790E-01	298	78	301	1	.910E-01
187	51	52	1	.146E+01	243	65	66	1	.992E+00	299	79	80	1	.992E+00
188	51	195	4	.373E+00	244	65	209	4	.526E+00	300	79	223	4	.433E+00
189	51	301	1	.870E-01	245	65	301	1	.940E-01	301	79	301	1	.108E+00
190	51	301	1	.830E-01	246	65	301	1	.870E-01	302	79	301	1	.870E-01
191	52	53	1	.146E+01	247	66	67	1	.172E+01	303	80	81	1	.108E+01
192	52	196	4	.373E+00	248	66	210	4	.433E+00	304	80	224	4	.526E+00
193	52	301	1	.870E-01	249	66	301	1	.930E-01	305	80	301	1	.930E-01
194	52	301	1	.830E-01	250	66	301	1	.103E+00	306	80	301	1	.910E-01
195	53	54	1	.146E+01	251	67	68	1	.210E+01	307	81	82	1	.146E+01
196	53	197	4	.373E+00	252	67	211	4	.288E+00	308	81	225	4	.373E+00
197	53	301	1	.870E-01	253	67	301	1	.930E-01	309	81	301	1	.840E-01
198	53	301	1	.830E-01	254	67	301	1	.125E+00	310	81	301	1	.830E-01
199	54	55	1	.146E+01	255	68	69	1	.125E+01	311	82	83	1	.146E+01
200	54	198	4	.373E+00	256	68	212	4	.348E+00	312	82	226	4	.373E+00
201	54	301	1	.870E-01	257	68	301	1	.990E-01	313	82	301	1	.850E-01
202	54	301	1	.830E-01	258	68	301	1	.172E+00	314	82	301	1	.820E-01
203	55	56	1	.146E+01	259	69	70	1	.120E+01	315	83	84	1	.146E+01
204	55	199	4	.373E+00	260	69	213	4	.348E+00	316	83	227	4	.373E+00
205	55	301	1	.870E-01	261	69	301	1	.990E-01	317	83	301	1	.850E-01
206	55	301	1	.830E-01	262	69	301	1	.171E+00	318	83	301	1	.820E-01
207	56	57	1	.146E+01	263	70	71	1	.115E+01	319	84	85	1	.146E+01
208	56	200	4	.373E+00	264	70	214	4	.473E+00	320	84	228	4	.373E+00
209	56	301	1	.870E-01	265	70	301	1	.900E-01	321	84	301	1	.860E-01
210	56	301	1	.820E-01	266	70	301	1	.157E+00	322	84	301	1	.820E-01
211	57	58	1	.146E+01	267	71	72	1	.115E+01	323	85	86	1	.146E+01
212	57	201	4	.373E+00	268	71	215	4	.473E+00	324	85	229	4	.373E+00
213	57	301	1	.860E-01	269	71	301	1	.710E-01	325	85	301	1	.860E-01
214	57	301	1	.820E-01	270	71	301	1	.138E+00	326	85	301	1	.820E-01
215	58	59	1	.146E+01	271	72	73	1	.115E+01	327	86	87	1	.146E+01
216	58	202	4	.373E+00	272	72	216	4	.473E+00	328	86	230	4	.373E+00
217	58	301	1	.860E-01	273	72	301	1	.330E-01	329	86	301	1	.860E-01
218	58	301	1	.820E-01	274	72	301	1	.670E-01	330	86	301	1	.820E-01
219	59	60	1	.146E+01	275	73	74	1	.115E+01	331	87	88	1	.146E+01
220	59	203	4	.373E+00	276	73	217	4	.473E+00	332	87	231	4	.373E+00
221	59	301	1	.860E-01	277	73	301	1	.670E-01	333	87	301	1	.860E-01
222	59	301	1	.820E-01	278	73	301	1	.310E-01	334	87	301	1	.820E-01
223	60	61	1	.146E+01	279	74	75	1	.115E+01	335	88	89	1	.146E+01
224	60	204	4	.373E+00	280	74	218	4	.473E+00	336	88	232	4	.373E+00

Brnh	From	To	Tag	Conduct
337	88	301	1	.850E-01
338	88	301	1	.820E-01
339	89	90	1	.146E+01
340	89	233	4	.373E+00
341	89	301	1	.850E-01
342	89	301	1	.810E-01
343	90	91	1	.146E+01
344	90	234	4	.373E+00
345	90	301	1	.850E-01
346	90	301	1	.810E-01
347	91	92	1	.146E+01
348	91	235	4	.373E+00
349	91	301	1	.850E-01
350	91	301	1	.810E-01
351	92	93	1	.146E+01
352	92	236	4	.373E+00
353	92	301	1	.850E-01
354	92	301	1	.810E-01
355	93	94	1	.146E+01
356	93	237	4	.373E+00
357	93	301	1	.850E-01
358	93	301	1	.810E-01
359	94	95	1	.146E+01
360	94	238	4	.373E+00
361	94	301	1	.850E-01
362	94	301	1	.810E-01
363	95	96	1	.146E+01
364	95	239	4	.373E+00
365	95	301	1	.850E-01
366	95	301	1	.810E-01
367	96	97	1	.129E+01
368	96	240	4	.373E+00
369	96	301	1	.840E-01
370	96	301	1	.800E-01
371	97	98	1	.115E+01
372	97	241	4	.473E+00
373	97	301	1	.900E-01
374	97	301	1	.930E-01
375	98	99	1	.115E+01
376	98	242	4	.473E+00
377	98	301	1	.690E-01
378	98	301	1	.123E+00
379	99	100	1	.115E+01
380	99	243	4	.473E+00
381	99	301	1	.260E-01
382	99	301	1	.149E+00
383	100	101	1	.115E+01
384	100	244	4	.473E+00
385	100	301	1	.380E-01
386	101	102	1	.115E+01
387	101	245	4	.473E+00
388	101	301	1	.920E-01
389	101	301	1	.720E-01
390	102	103	1	.129E+01
391	102	246	4	.473E+00
392	102	301	1	.124E+00
393	102	301	1	.900E-01
394	103	104	1	.146E+01
395	103	247	4	.373E+00
396	103	301	1	.760E-01
397	103	301	1	.840E-01
398	104	105	1	.146E+01
399	104	248	4	.373E+00
400	104	301	1	.780E-01
401	104	301	1	.840E-01
402	105	106	1	.146E+01
403	105	249	4	.373E+00
404	105	301	1	.790E-01
405	105	301	1	.830E-01
406	106	107	1	.146E+01
407	106	250	4	.373E+00
408	106	301	1	.810E-01
409	106	301	1	.830E-01
410	107	108	1	.146E+01
411	107	251	4	.373E+00
412	107	301	1	.820E-01
413	107	301	1	.830E-01
414	108	109	1	.146E+01
415	108	252	4	.373E+00
416	108	301	1	.840E-01
417	108	301	1	.830E-01
418	109	110	1	.146E+01
419	109	253	4	.373E+00
420	109	301	1	.850E-01
421	109	301	1	.830E-01
422	110	111	1	.146E+01
423	110	254	4	.373E+00
424	110	301	1	.850E-01
425	110	301	1	.830E-01
426	111	112	1	.146E+01
427	111	255	4	.373E+00
428	111	301	1	.850E-01
429	111	301	1	.830E-01
430	112	113	1	.146E+01
431	112	256	4	.373E+00
432	112	301	1	.850E-01
433	112	301	1	.830E-01
434	113	114	1	.146E+01
435	113	257	4	.373E+00
436	113	301	1	.850E-01
437	113	301	1	.830E-01
438	114	115	1	.146E+01
439	114	258	4	.373E+00
440	114	301	1	.850E-01
441	114	301	1	.830E-01
442	115	116	1	.146E+01
443	115	259	4	.373E+00
444	115	301	1	.840E-01
445	115	301	1	.830E-01
446	116	117	1	.146E+01
447	116	260	4	.373E+00
448	116	301	1	.840E-01
449	116	301	1	.830E-01
450	117	118	1	.146E+01
451	117	261	4	.373E+00
452	117	301	1	.830E-01
453	117	301	1	.830E-01
454	118	119	1	.129E+01
455	118	262	4	.373E+00
456	118	301	1	.820E-01
457	118	301	1	.840E-01
458	119	120	1	.115E+01
459	119	263	4	.473E+00
460	119	301	1	.860E-01
461	119	301	1	.960E-01
462	120	121	1	.115E+01
463	120	264	4	.473E+00
464	120	301	1	.650E-01
465	120	301	1	.113E+00
466	121	122	1	.115E+01
467	121	265	4	.473E+00
468	121	301	1	.220E-01
469	121	301	1	.133E+00
470	122	123	1	.115E+01
471	122	266	4	.473E+00
472	122	301	1	.420E-01
473	123	124	1	.115E+01
474	123	267	4	.473E+00
475	123	301	1	.760E-01
476	124	125	1	.129E+01
477	124	268	4	.473E+00
478	124	301	1	.940E-01
479	125	126	1	.146E+01
480	125	269	4	.373E+00
481	125	301	1	.490E-01
482	125	301	1	.860E-01
483	126	127	1	.146E+01
484	126	270	4	.373E+00
485	126	301	1	.680E-01
486	126	301	1	.860E-01
487	127	128	1	.146E+01
488	127	271	4	.373E+00
489	127	301	1	.820E-01
490	127	301	1	.850E-01
491	128	129	1	.146E+01
492	128	272	4	.373E+00
493	128	301	1	.910E-01
494	128	301	1	.840E-01
495	129	130	1	.146E+01
496	129	273	4	.373E+00
497	129	301	1	.970E-01
498	129	301	1	.830E-01
499	130	131	1	.146E+01
500	130	274	4	.373E+00
501	130	301	1	.100E+00
502	130	301	1	.830E-01
503	131	132	1	.146E+01
504	131	275	4	.373E+00

Brnh	From	To	Tag	Conduct
505	131	301	1	.101E+00
506	131	301	1	.830E-01
507	132	133	1	.146E+01
508	132	276	4	.373E+00
509	132	301	1	.100E+00
510	132	301	1	.830E-01
511	133	134	1	.146E+01
512	133	277	4	.373E+00
513	133	301	1	.970E-01
514	133	301	1	.830E-01
515	134	135	1	.146E+01
516	134	278	4	.373E+00
517	134	301	1	.910E-01
518	134	301	1	.840E-01
519	135	136	1	.146E+01
520	135	279	4	.373E+00
521	135	301	1	.820E-01
522	135	301	1	.840E-01
523	136	137	1	.146E+01
524	136	280	4	.373E+00
525	136	301	1	.680E-01
526	136	301	1	.860E-01
527	137	138	1	.146E+01
528	137	281	4	.373E+00
529	137	301	1	.490E-01
530	137	301	1	.870E-01
531	138	139	1	.146E+01
532	138	282	4	.373E+00
533	138	301	1	.240E-01
534	138	301	1	.880E-01
535	139	140	1	.146E+01
536	139	283	4	.373E+00
537	139	301	1	.900E-01
538	140	141	1	.160E+01
539	140	284	4	.373E+00
540	140	301	1	.910E-01
541	141	142	1	.178E+01
542	141	285	4	.306E+00
543	142	143	1	.178E+01
544	142	286	4	.306E+00
545	143	144	1	.178E+01
546	143	287	4	.306E+00
547	144	288	4	.306E+00
548	145	302	5	.790E+02
549	146	145	5	.790E+02
550	147	146	5	.790E+02
551	148	147	5	.790E+02
552	149	148	5	.790E+02
553	150	149	5	.790E+02
554	151	150	5	.790E+02
555	152	151	5	.790E+02
556	153	152	5	.790E+02
557	154	153	5	.790E+02
558	155	154	5	.790E+02
559	156	155	5	.790E+02
560	157	156	5	.790E+02
561	158	157	5	.790E+02
562	159	158	5	.790E+02
563	160	159	5	.790E+02
564	161	160	5	.790E+02
565	162	161	5	.790E+02
566	163	162	5	.790E+02
567	164	163	5	.790E+02
568	165	164	5	.790E+02
569	166	165	5	.790E+02
570	167	166	5	.790E+02
571	168	167	5	.790E+02
572	169	168	5	.790E+02
573	170	169	5	.790E+02
574	171	170	5	.790E+02
575	172	171	5	.790E+02
576	173	172	5	.790E+02
577	174	173	5	.790E+02
578	175	174	5	.790E+02
579	176	175	5	.790E+02
580	177	176	5	.790E+02
581	178	177	5	.790E+02
582	179	178	5	.790E+02
583	180	179	5	.790E+02
584	181	180	5	.790E+02
585	182	181	5	.790E+02
586	183	182	5	.790E+02
587	184	183	5	.790E+02
588	185	184	5	.790E+02
589	186	185	5	.790E+02
590	187	186	5	.790E+02
591	188	187	5	.790E+02
592	189	188	5	.790E+02
593	190	189	5	.790E+02
594	191	190	5	.790E+02
595	192	191	5	.790E+02
596	193	192	5	.790E+02
597	194	193	5	.790E+02
598	195	194	5	.790E+02
599	196	195	5	.790E+02
600	197	196	5	.790E+02
601	198	197	5	.790E+02
602	199	198	5	.790E+02
603	200	199	5	.790E+02
604	201	200	5	.790E+02
605	202	201	5	.790E+02
606	203	202	5	.790E+02
607	204	203	5	.790E+02
608	205	204	5	.790E+02
609	206	205	5	.790E+02
610	207	206	5	.790E+02
611	208	207	5	.790E+02
612	209	208	5	.790E+02
613	210	209	5	.790E+02
614	211	210	5	.790E+02
615	212	211	5	.790E+02
616	213	212	5	.790E+02
617	214	213	5	.790E+02
618	215	214	5	.790E+02
619	216	215	5	.790E+02
620	217	216	5	.790E+02
621	218	217	5	.790E+02
622	219	218	5	.790E+02
623	220	219	5	.790E+02
624	221	220	5	.790E+02
625	222	221	5	.790E+02
626	223	222	5	.790E+02
627	224	223	5	.790E+02
628	225	224	5	.790E+02
629	226	225	5	.790E+02
630	227	226	5	.790E+02
631	228	227	5	.790E+02
632	229	228	5	.790E+02
633	230	229	5	.790E+02
634	231	230	5	.790E+02
635	232	231	5	.790E+02
636	233	232	5	.790E+02
637	234	233	5	.790E+02
638	235	234	5	.790E+02
639	236	235	5	.790E+02
640	237	236	5	.790E+02
641	238	237	5	.790E+02
642	239	238	5	.790E+02
643	240	239	5	.790E+02
644	241	240	5	.790E+02
645	242	241	5	.790E+02
646	243	242	5	.790E+02
647	244	243	5	.790E+02
648	245	244	5	.790E+02
649	246	245	5	.790E+02
650	247	246	5	.790E+02
651	248	247	5	.790E+02
652	249	248	5	.790E+02
653	250	249	5	.790E+02
654	251	250	5	.790E+02
655	252	251	5	.790E+02
656	253	252	5	.790E+02
657	254	253	5	.790E+02
658	255	254	5	.790E+02
659	256	255	5	.790E+02
660	257	256	5	.790E+02
661	258	257	5	.790E+02
662	259	258	5	.790E+02
663	260	259	5	.790E+02
664	261	260	5	.790E+02
665	262	261	5	.790E+02
666	263	262	5	.790E+02
667	264	263	5	.790E+02
668	265	264	5	.790E+02
669	266	265	5	.790E+02
670	267	266	5	.790E+02
671	268	267	5	.790E+02
672	269	268	5	.790E+02

Brnh	From	To	Tag	Conduct
673	270	269	5	.790E+02
674	271	270	5	.790E+02
675	272	271	5	.790E+02
676	273	272	5	.790E+02
677	274	273	5	.790E+02
678	275	274	5	.790E+02
679	276	275	5	.790E+02
680	277	276	5	.790E+02
681	278	277	5	.790E+02
682	279	278	5	.790E+02
683	280	279	5	.790E+02
684	281	280	5	.790E+02
685	282	281	5	.790E+02
686	283	282	5	.790E+02
687	284	283	5	.790E+02
688	285	284	5	.790E+02
689	286	285	5	.790E+02
690	287	286	5	.790E+02
691	288	287	5	.790E+02

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          TASS GENERAL INPUT MENU - SI Units

          (1) Case Title:
TALSR(METRIC)---RUN 4. COMPLEX MODEL, MASS FLOW OF 272.2 kg/hr (600 lbm/hr)

          (2) Nodes                                   288

          (3) Constant Temperatures                     2

          (4) Unique Exponents                          0

          (5) Temperature Dependent Conductances        0

          (6) Temperature Dependent Heat Inputs         0

          (7) Computational Accuracy                .0100

          (8) Starting Temperature                   25.0

          Are these inputs correct (Y/N) ?  Y
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INPUT DATA

Fin Length (L) (cm)	Fin Thickness (cm)	Fin spacing (z) (cm)	Thermal Conductivity of Copper (k) (W/cm-K)	Reynolds Number	Prandtl Number	Outer pipe diameter (cm)	Inner pipe diameter (cm)	Pipe Area (sq. cm)
0.318	0.015	0.0533	4.01	1900.00	0.707	0.635	0.483	0.134

K-Value	Channel Width (b) (cm)	Effective Diameter (cm)	Heat Transfer Coefficent (h) (W/sqcm-K)	b-Term (cm)	Yin,f (W/K)	Dist. between Nodes (cm)	Fins/node	K - Value (W/K)
K1			N/A			0.302	N/A	1.7784
K2			2.040			0.302	N/A	0.9329
K3			N/A			0.334	N/A	1.6043
K4			N/A			0.367	N/A	1.4612
K5			2.040			0.367	N/A	1.1354
K6	1.143	0.1019	0.03626	0.68200	0.01333	0.367	6.880	0.0954
K7	1.143	0.1019	0.03626	0.66800	0.01314	0.367	6.880	0.0940
K8	1.143	0.1019	0.03626	0.65200	0.01291	0.367	6.880	0.0924
K9	0.094	0.0681	0.04746		0.00282	0.367	6.880	0.0241
K10	1.143	0.1019	0.03626	0.63500	0.01266	0.367	6.880	0.0907
K11	0.269	0.0890	0.03967		0.00658	0.367	6.880	0.0492
K12	1.143	0.1019	0.03626	0.62100	0.01245	0.367	6.880	0.0893
K13	0.414	0.0945	0.03813		0.00937	0.367	6.880	0.0682
K14	1.143	0.1019	0.03626	0.60800	0.01226	0.367	6.880	0.0879
K15	0.631	0.0969	0.03749		0.01136	0.367	6.880	0.0819
K16	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K17	0.620	0.0982	0.03716		0.01271	0.367	6.880	0.0911
K18	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K19	0.681	0.0989	0.03698		0.01354	0.367	6.880	0.0969
k20	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
k21	0.716	0.0993	0.03690		0.01400	0.367	6.880	0.1000
k22	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
k23	0.732	0.0994	0.03686		0.01419	0.367	6.880	0.1013
k24	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
k25	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
k26	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
k27	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
k28	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
k29			N/A			0.416	N/A	1.2907
K30	1.143	0.1019	0.03626	0.60200	0.01218	0.367	6.880	0.0873
K31			N/A			0.465	N/A	1.1524
K32			2.040			0.465	N/A	1.4397
K33	1.104	0.1018	0.03629	0.59000	0.01199	0.465	7.540	0.0944
K34	0.808	0.1001	0.03670	0.44800	0.00968	0.465	7.540	0.0770
K35	0.296	0.0904	0.03928	0.20300	0.00498	0.465	7.540	0.0419
K36	2.037	0.1040	0.03578	1.10100	0.01745	0.465	7.540	0.1355
K37	0.296	0.0904	0.03928	0.09300	0.00231	0.465	7.540	0.0218
K38	1.496	0.1030	0.03600	0.82200	0.01501	0.465	7.540	0.1171
K39	0.808	0.1001	0.03670	0.36000	0.00798	0.465	7.540	0.0642
K40	1.184	0.1021	0.03622	0.65100	0.01288	0.465	7.540	0.1012
K41	1.104	0.1018	0.03629	0.61400	0.01075	0.465	7.540	0.0850

K42	1.143	0.1019	0.03626	0.61600	0.01241	0.367	6.880	0.0890
K43	1.143	0.1019	0.03626	0.54100	0.01119	0.367	6.880	0.0806
K44	1.143	0.1019	0.03626	0.61000	0.01229	0.367	6.880	0.0881
K45	1.143	0.1019	0.03626	0.54700	0.01129	0.367	6.880	0.0813
K46	1.143	0.1019	0.03626	0.60300	0.01218	0.367	6.880	0.0874
K47	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K48	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K49	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K50	1.143	0.1019	0.03626	0.59500	0.01206	0.367	6.880	0.0866
K51	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K52	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K53	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K54	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K55	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K56	1.143	0.1019	0.03626	0.58900	0.01196	0.367	6.880	0.0859
K57	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K58	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K59	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K60	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K61	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K62	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K63	1.143	0.1019	0.03626	0.53500	0.01109	0.367	6.880	0.0799
K64	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K65	1.143	0.1019	0.03626	0.52200	0.01087	0.367	6.880	0.0784
K66	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K67	1.143	0.1019	0.03626	0.50800	0.01063	0.367	6.880	0.0768
K68	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K69	1.143	0.1019	0.03626	0.49100	0.01034	0.367	6.880	0.0747
K70	1.143	0.1019	0.03626	0.57800	0.01179	0.367	6.880	0.0847
K71	1.143	0.1019	0.03626	0.47600	0.01005	0.367	6.880	0.0728
K72	1.143	0.1019	0.03626	0.57800	0.01179	0.367	6.880	0.0847
K73	1.143	0.1019	0.03626	0.46100	0.00980	0.367	6.880	0.0711
K74	1.104	0.1018	0.03629	0.55900	0.01150	0.465	7.540	0.0907
K75	0.888	0.1006	0.03657		0.01591	0.465	7.540	0.1240
K76	0.808	0.1001	0.03670	0.41800	0.00911	0.465	7.540	0.0728
K77	0.550	0.0973	0.03741		0.01167	0.465	7.540	0.0921
K78	0.298	0.0904	0.03928	0.18500	0.00456	0.465	7.540	0.0386
K79	2.931	0.1048	0.03560	1.48800	0.01932	0.465	7.540	0.1496
K80	0.298	0.0904	0.03928	0.11100	0.00275	0.465	7.540	0.0251
K81	1.850	0.1037	0.03584	0.95000	0.01625	0.465	7.540	0.1265
K82	0.808	0.1001	0.03670	0.39000	0.00857	0.465	7.540	0.0687
K83	1.226	0.1022	0.03618	0.64500	0.01279	0.465	7.540	0.1004
K84	1.104	0.1018	0.03629	0.54500	0.01127	0.465	7.540	0.0890
K85	1.143	0.1019	0.03626	0.60400	0.01220	0.367	6.880	0.0876
K86	1.143	0.1019	0.03626	0.56500	0.01158	0.367	6.880	0.0833
K87	1.143	0.1019	0.03626	0.60300	0.01218	0.367	6.880	0.0874
K88	1.143	0.1019	0.03626	0.56500	0.01158	0.367	6.880	0.0833
K89	1.143	0.1019	0.03626	0.60200	0.01216	0.367	6.880	0.0873
K90	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K91	1.143	0.1019	0.03626	0.60000	0.01213	0.367	6.880	0.0871
K92	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K93	1.143	0.1019	0.03626	0.59900	0.01212	0.367	6.880	0.0870

K94	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K95	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K96	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K97	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
K98	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K99	1.143	0.1019	0.03626	0.59500	0.01208	0.367	6.880	0.0866
K100	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K101	1.143	0.1019	0.03626	0.59400	0.01204	0.367	6.880	0.0864
K102	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K103	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K104	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K105	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K106	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K107	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K108	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K109	1.143	0.1019	0.03626	0.58900	0.01196	0.367	6.880	0.0859
K110	1.143	0.1019	0.03626	0.54500	0.01128	0.367	6.880	0.0810
K111	1.143	0.1019	0.03626	0.58700	0.01193	0.367	6.880	0.0857
K112	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K113	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K114	1.143	0.1019	0.03626	0.53300	0.01108	0.367	6.880	0.0797
K115			N/A			0.498	N/A	1.0819
K116	1.143	0.1019	0.03626	0.58600	0.01190	0.367	6.880	0.0855
K117	1.143	0.1019	0.03626	0.52600	0.01092	0.367	6.880	0.0788
K118			N/A			0.641	N/A	0.992
K119			2.040			0.518	N/A	1.603
K120	1.143	0.1019	0.03626	0.58300	0.01187	0.541	7.540	0.0936
K121	1.184	0.1021	0.03622	0.53400	0.01108	0.541	7.540	0.0874
K122			N/A			0.312	N/A	1.717
K123			2.040			0.427	N/A	1.320
K124	1.143	0.1019	0.03626	0.58100	0.01184	0.312	7.540	0.0933
K125	1.498	0.1030	0.03600	0.67400	0.01314	0.312	7.540	0.1031
K126			N/A			0.256	N/A	2.100
K127			2.040			0.284	N/A	0.878
K128	1.143	0.1019	0.03626	0.58000	0.01182	0.256	7.540	0.0931
K129	2.037	0.1040	0.03578	0.93600	0.01610	0.256	7.540	0.1264
K130			N/A			0.429	N/A	1.251
K131			2.040			0.343	N/A	1.061
K132	1.143	0.1019	0.03626	0.57900	0.01181	0.429	8.040	0.0992
K133	2.907	0.10476	0.03580		0.02086	0.429	8.040	0.1720
K134			N/A			0.447	N/A	1.200
K135	1.143	0.1019	0.03626	0.57600	0.01176	0.429	8.040	0.0989
K136	2.482	0.10444	0.03567		0.02077	0.429	8.040	0.1712
K137	1.104	0.1016	0.03629	0.55500	0.01143	0.465	7.540	0.0602
K138	1.840	0.10368	0.03585		0.02026	0.465	7.540	0.1567
K139	0.808	0.1001	0.03670	0.40700	0.00860	0.465	7.540	0.0712
K140	1.119	0.10182	0.03628		0.01776	0.465	7.540	0.1378
K141	0.298	0.0904	0.03928	0.15100	0.00373	0.465	7.540	0.0325
K142	0.359	0.09288	0.03857		0.00834	0.465	7.540	0.0672
K143	0.298	0.0904	0.03928	0.14500	0.00358	0.465	7.540	0.0314
K144	0.808	0.1001	0.03670	0.40100	0.00879	0.465	7.540	0.0703
K145	1.104	0.1016	0.03629	0.54900	0.01133	0.465	7.540	0.0695

K146	1.143	0.1019	0.03626	0.56700	0.01161	0.429	8.040	0.0977
K147	1.143	0.1019	0.03626	0.56400	0.01157	0.429	8.040	0.0973
K148	2.037	0.1040	0.03578	0.97600	0.01647	0.255	7.540	0.1242
K149	1.143	0.1019	0.03626	0.56300	0.01155	0.265	7.540	0.0911
K150	1.496	0.1030	0.03600	0.71900	0.01376	0.312	7.540	0.1077
K151	1.143	0.1019	0.03626	0.56200	0.01153	0.312	7.540	0.0870
K152	1.184	0.1021	0.03622	0.58200	0.01184	0.541	7.540	0.0933
K153	1.143	0.1019	0.03626	0.56000	0.01150	0.541	7.540	0.0907
K154	1.143	0.1019	0.03626	0.57300	0.01171	0.367	6.880	0.0842
K155	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K156	1.143	0.1019	0.03626	0.57900	0.01161	0.367	6.880	0.0848
K157	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K158	1.143	0.1019	0.03626	0.58200	0.01165	0.367	6.880	0.0852
K159	1.143	0.1019	0.03626	0.55600	0.01144	0.367	6.880	0.0823
K160	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K161	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K162	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0856
K163	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K164	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K165	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K166	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K167	1.143	0.1019	0.03626	0.55000	0.01134	0.367	6.880	0.0816
K168	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K169	1.143	0.1019	0.03626	0.54900	0.01132	0.367	6.880	0.0815
K170	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K171	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K172	1.143	0.1019	0.03626	0.58300	0.01187	0.367	6.880	0.0853
K173	1.143	0.1019	0.03626	0.54700	0.01129	0.367	6.880	0.0813
K174	1.143	0.1019	0.03626	0.58200	0.01185	0.367	6.880	0.0852
K175	1.143	0.1019	0.03626	0.54600	0.01128	0.367	6.880	0.0810
K176	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K177	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.880	0.0809
K178	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K179	1.143	0.1019	0.03626	0.54300	0.01122	0.367	6.880	0.0808
K180	1.143	0.1019	0.03626	0.57700	0.01177	0.367	6.880	0.0846
K181	1.143	0.1019	0.03626	0.54100	0.01119	0.367	6.880	0.0806
K182	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K183	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K184	1.143	0.1019	0.03626	0.57500	0.01174	0.367	6.880	0.0844
K185	1.143	0.1019	0.03626	0.53900	0.01116	0.367	6.880	0.0804
K186	1.104	0.1018	0.03629	0.55300	0.01140	0.465	7.540	0.0900
K187	1.226	0.1022	0.03618	0.58000	0.01180	0.465	7.540	0.0930
K188	0.608	0.1001	0.03670	0.39500	0.00867	0.465	7.540	0.0694
K189	1.850	0.1037	0.03584	0.89900	0.01577	0.465	7.540	0.1229
K190	0.296	0.0904	0.03928	0.11600	0.00288	0.465	7.540	0.0260
K191	2.931	0.1048	0.03560	1.44400	0.01917	0.465	7.540	0.1485
K192	0.296	0.0904	0.03928	0.18000	0.00443	0.465	7.540	0.0377
K193	0.608	0.1001	0.03670	0.41300	0.00902	0.465	7.540	0.0721
K194	1.104	0.1018	0.03629	0.55100	0.01138	0.465	7.540	0.0897
K195	1.143	0.1019	0.03626	0.50400	0.01056	0.367	6.880	0.0763
K196	1.143	0.1019	0.03626	0.56800	0.01163	0.367	6.880	0.0836
K197	1.143	0.1019	0.03626	0.51700	0.01079	0.367	6.880	0.0778

K198	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K199	1.143	0.1019	0.03626	0.53100	0.01102	0.367	6.880	0.0794
K200	1.143	0.1019	0.03626	0.56600	0.01160	0.367	6.880	0.0834
K201	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.880	0.0809
K202	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K203	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K204	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K205	1.143	0.1019	0.03626	0.56800	0.01163	0.367	6.880	0.0836
K206	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K207	1.143	0.1019	0.03626	0.57600	0.01176	0.367	6.880	0.0845
K208	1.143	0.1019	0.03626	0.56000	0.01150	0.367	6.880	0.0827
K209	1.143	0.1019	0.03626	0.58100	0.01184	0.367	6.880	0.0850
K210	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K211	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K212	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K213	1.143	0.1019	0.03626	0.58400	0.01188	0.367	6.880	0.0854
K214	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K215	1.143	0.1019	0.03626	0.58300	0.01187	0.367	6.880	0.0853
K216	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K217	1.143	0.1019	0.03626	0.58000	0.01182	0.367	6.880	0.0849
K218	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K219	1.143	0.1019	0.03626	0.57400	0.01173	0.367	6.880	0.0843
K220	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K221	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K222	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K223	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K224	1.143	0.1019	0.03626	0.56400	0.01157	0.367	6.880	0.0832
K225	1.143	0.1019	0.03626	0.55000	0.01134	0.367	6.880	0.0816
K226	1.143	0.1019	0.03626	0.57000	0.01166	0.367	6.880	0.0838
K227	1.104	0.1018	0.03629	0.62200	0.01088	0.466	7.540	0.0861
K228	1.184	0.1021	0.03622	0.60200	0.01215	0.465	7.540	0.0956
K229	0.808	0.1001	0.03670	0.36500	0.00808	0.465	7.540	0.0650
K230	1.498	0.1030	0.03600	0.77600	0.01449	0.465	7.540	0.1133
K231	0.296	0.0904	0.03928	0.09400	0.00234	0.465	7.540	0.0220
K232	2.037	0.1040	0.03578	1.06100	0.01716	0.465	7.540	0.1333
K233	0.296	0.0904	0.03928	0.20200	0.00496	0.465	7.540	0.0417
K234	0.808	0.1001	0.03670	0.44300	0.00958	0.465	7.540	0.0783
K235	1.104	0.1018	0.03629	0.58200	0.01186	0.465	7.540	0.0935
K236	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K237	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K238	1.143	0.1019	0.03626	0.57600	0.01178	0.367	6.880	0.0845
K239	1.143	0.1019	0.03626	0.56900	0.01165	0.367	6.880	0.0837
K240	1.143	0.1019	0.03626	0.56300	0.01155	0.367	6.880	0.0831
K241	1.143	0.1019	0.03626	0.56000	0.01150	0.367	6.880	0.0827
K242	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K243	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0826
K244	1.143	0.1019	0.03626	0.56200	0.01153	0.367	6.880	0.0830
K245	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.880	0.0835
K246	1.143	0.1019	0.03626	0.57500	0.01174	0.367	6.880	0.0844
K247	1.143	0.1019	0.03626	0.58800	0.01192	0.367	6.880	0.0856
K248	1.143	0.1019	0.03626	0.59900	0.01212	0.367	6.880	0.0870
K249	1.143	0.1019	0.03626	0.61200	0.01232	0.367	6.880	0.0884

K250	1.143	0.1019	0.03626	0.62600	0.01253	0.367	6.880	0.0898
K251	1.143	0.1019	0.03626	0.63900	0.01272	0.367	6.880	0.0911
K252	N/A	N/A	N/A	N/A	N/A	N/A	N/A	316.1600

TASS Branch Connection Summary in W/degC or Watts if Tag = 10

Brnh	From	To	Tag	Conduct
1	1	2	1	.178E+01
2	1	145	4	.933E+00
3	2	3	1	.178E+01
4	2	146	4	.933E+00
5	3	4	1	.178E+01
6	3	147	4	.933E+00
7	4	5	1	.160E+01
8	4	148	4	.933E+00
9	5	6	1	.146E+01
10	5	149	4	.114E+01
11	5	301	1	.954E-01
12	6	7	1	.146E+01
13	6	150	4	.114E+01
14	6	301	1	.940E-01
15	7	8	1	.146E+01
16	7	151	4	.114E+01
17	7	301	1	.920E-01
18	7	301	1	.240E-01
19	8	9	1	.146E+01
20	8	152	4	.114E+01
21	8	301	1	.910E-01
22	8	301	1	.490E-01
23	9	10	1	.146E+01
24	9	153	4	.114E+01
25	9	301	1	.890E-01
26	9	301	1	.680E-01
27	10	11	1	.146E+01
28	10	154	4	.114E+01
29	10	301	1	.880E-01
30	10	301	1	.820E-01
31	11	12	1	.146E+01
32	11	155	4	.114E+01
33	11	301	1	.870E-01
34	11	301	1	.910E-01
35	12	13	1	.146E+01
36	12	156	4	.114E+01
37	12	301	1	.860E-01
38	12	301	1	.970E-01
39	13	14	1	.146E+01
40	13	157	4	.114E+01
41	13	301	1	.850E-01
42	13	301	1	.100E+00
43	14	15	1	.146E+01
44	14	158	4	.114E+01
45	14	301	1	.850E-01
46	14	301	1	.101E+00
47	15	16	1	.146E+01
48	15	159	4	.114E+01
49	15	301	1	.850E-01
50	15	301	1	.100E+00
51	16	17	1	.146E+01
52	16	160	4	.114E+01
53	16	301	1	.850E-01
54	16	301	1	.970E-01
57	17	301	1	.860E-01
58	17	301	1	.910E-01
59	18	19	1	.146E+01
60	18	162	4	.114E+01
61	18	301	1	.860E-01
62	18	301	1	.820E-01
63	19	20	1	.146E+01
64	19	163	4	.114E+01
65	19	301	1	.870E-01
66	19	301	1	.680E-01
67	20	21	1	.129E+01
68	20	164	4	.114E+01
69	20	301	1	.870E-01
70	20	301	1	.490E-01
71	21	22	1	.115E+01
72	21	165	4	.144E+01
73	21	301	1	.940E-01
74	22	23	1	.115E+01
75	22	166	4	.144E+01
76	22	301	1	.770E-01
77	23	24	1	.115E+01
78	23	167	4	.144E+01
79	23	301	1	.420E-01
80	24	25	1	.115E+01
81	24	168	4	.144E+01
82	24	301	1	.136E+00
83	24	301	1	.220E-01
84	25	26	1	.115E+01
85	25	169	4	.144E+01
86	25	301	1	.117E+00
87	25	301	1	.640E-01
88	26	27	1	.129E+01
89	26	170	4	.144E+01
90	26	301	1	.101E+00
91	26	301	1	.850E-01
92	27	28	1	.146E+01
93	27	171	4	.114E+01
94	27	301	1	.890E-01
95	27	301	1	.810E-01
96	28	29	1	.146E+01
97	28	172	4	.114E+01
98	28	301	1	.880E-01
99	28	301	1	.810E-01
100	29	30	1	.146E+01
101	29	173	4	.114E+01
102	29	301	1	.870E-01
103	29	301	1	.820E-01
104	30	31	1	.146E+01
105	30	174	4	.114E+01
106	30	301	1	.870E-01
107	30	301	1	.830E-01
108	31	32	1	.146E+01
109	31	175	4	.114E+01
110	31	301	1	.870E-01
113	32	176	4	.114E+01
114	32	301	1	.860E-01
115	32	301	1	.830E-01
116	33	34	1	.146E+01
117	33	177	4	.114E+01
118	33	301	1	.860E-01
119	33	301	1	.830E-01
120	34	35	1	.146E+01
121	34	178	4	.114E+01
122	34	301	1	.860E-01
123	34	301	1	.830E-01
124	35	36	1	.146E+01
125	35	179	4	.114E+01
126	35	301	1	.860E-01
127	35	301	1	.820E-01
128	36	37	1	.146E+01
129	36	180	4	.114E+01
130	36	301	1	.860E-01
131	36	301	1	.810E-01
132	37	38	1	.146E+01
133	37	181	4	.114E+01
134	37	301	1	.850E-01
135	37	301	1	.800E-01
136	38	39	1	.146E+01
137	38	182	4	.114E+01
138	38	301	1	.850E-01
139	38	301	1	.780E-01
140	39	40	1	.146E+01
141	39	183	4	.114E+01
142	39	301	1	.850E-01
143	39	301	1	.770E-01
144	40	41	1	.146E+01
145	40	184	4	.114E+01
146	40	301	1	.850E-01
147	40	301	1	.750E-01
148	41	42	1	.146E+01
149	41	185	4	.114E+01
150	41	301	1	.850E-01
151	41	301	1	.730E-01
152	42	43	1	.129E+01
153	42	186	4	.114E+01
154	42	301	1	.850E-01
155	42	301	1	.710E-01
156	43	44	1	.115E+01
157	43	187	4	.144E+01
158	43	301	1	.910E-01
159	43	301	1	.124E+00
160	44	45	1	.115E+01
161	44	188	4	.144E+01
162	44	301	1	.730E-01
163	44	301	1	.920E-01
164	45	46	1	.115E+01
165	45	189	4	.144E+01
166	45	301	1	.390E-01

55	17	18	1	.146E+01	111	31	301	1	.830E-01	167	46	47	1	.115E+01
56	17	161	4	.114E+01	112	32	33	1	.146E+01	168	46	190	4	.144E+01

Brnh	From	To	Tag	Conduct
169	46	301	1	.150E+00
170	46	301	1	.250E-01
171	47	48	1	.115E+01
172	47	191	4	.144E+01
173	47	301	1	.127E+00
174	47	301	1	.690E-01
175	48	49	1	.129E+01
176	48	192	4	.144E+01
177	48	301	1	.100E+00
178	48	301	1	.890E-01
179	49	50	1	.146E+01
180	49	193	4	.114E+01
181	49	301	1	.880E-01
182	49	301	1	.830E-01
183	50	51	1	.146E+01
184	50	194	4	.114E+01
185	50	301	1	.870E-01
186	50	301	1	.830E-01
187	51	52	1	.146E+01
188	51	195	4	.114E+01
189	51	301	1	.870E-01
190	51	301	1	.830E-01
191	52	53	1	.146E+01
192	52	196	4	.114E+01
193	52	301	1	.870E-01
194	52	301	1	.830E-01
195	53	54	1	.146E+01
196	53	197	4	.114E+01
197	53	301	1	.870E-01
198	53	301	1	.830E-01
199	54	55	1	.146E+01
200	54	198	4	.114E+01
201	54	301	1	.870E-01
202	54	301	1	.830E-01
203	55	56	1	.146E+01
204	55	199	4	.114E+01
205	55	301	1	.870E-01
206	55	301	1	.830E-01
207	56	57	1	.146E+01
208	56	200	4	.114E+01
209	56	301	1	.870E-01
210	56	301	1	.820E-01
211	57	58	1	.146E+01
212	57	201	4	.114E+01
213	57	301	1	.860E-01
214	57	301	1	.820E-01
215	58	59	1	.146E+01
216	58	202	4	.114E+01
217	58	301	1	.860E-01
218	58	301	1	.820E-01
219	59	60	1	.146E+01
220	59	203	4	.114E+01
221	59	301	1	.860E-01
222	59	301	1	.820E-01
223	60	61	1	.146E+01
224	60	204	4	.114E+01

Brnh	From	To	Tag	Conduct
225	60	301	1	.860E-01
226	60	301	1	.810E-01
227	61	62	1	.146E+01
228	61	205	4	.114E+01
229	61	301	1	.860E-01
230	61	301	1	.810E-01
231	62	63	1	.146E+01
232	62	206	4	.114E+01
233	62	301	1	.860E-01
234	62	301	1	.810E-01
235	63	64	1	.146E+01
236	63	207	4	.114E+01
237	63	301	1	.860E-01
238	63	301	1	.800E-01
239	64	65	1	.108E+01
240	64	208	4	.114E+01
241	64	301	1	.860E-01
242	64	301	1	.790E-01
243	65	66	1	.992E+00
244	65	209	4	.160E+01
245	65	301	1	.940E-01
246	65	301	1	.870E-01
247	66	67	1	.172E+01
248	66	210	4	.132E+01
249	66	301	1	.930E-01
250	66	301	1	.103E+00
251	67	68	1	.210E+01
252	67	211	4	.878E+00
253	67	301	1	.930E-01
254	67	301	1	.125E+00
255	68	69	1	.125E+01
256	68	212	4	.106E+01
257	68	301	1	.990E-01
258	68	301	1	.172E+00
259	69	70	1	.120E+01
260	69	213	4	.106E+01
261	69	301	1	.990E-01
262	69	301	1	.171E+00
263	70	71	1	.115E+01
264	70	214	4	.144E+01
265	70	301	1	.900E-01
266	70	301	1	.157E+00
267	71	72	1	.115E+01
268	71	215	4	.144E+01
269	71	301	1	.710E-01
270	71	301	1	.138E+00
271	72	73	1	.115E+01
272	72	216	4	.144E+01
273	72	301	1	.330E-01
274	72	301	1	.670E-01
275	73	74	1	.115E+01
276	73	217	4	.144E+01
277	73	301	1	.670E-01
278	73	301	1	.310E-01
279	74	75	1	.115E+01
280	74	218	4	.144E+01

Brnh	From	To	Tag	Conduct
281	74	301	1	.138E+00
282	74	301	1	.700E-01
283	75	76	1	.120E+01
284	75	219	4	.144E+01
285	75	301	1	.157E+00
286	75	301	1	.900E-01
287	76	77	1	.125E+01
288	76	220	4	.106E+01
289	76	301	1	.171E+00
290	76	301	1	.980E-01
291	77	78	1	.210E+01
292	77	221	4	.106E+01
293	77	301	1	.172E+00
294	77	301	1	.970E-01
295	78	79	1	.172E+01
296	78	222	4	.878E+00
297	78	301	1	.124E+00
298	78	301	1	.910E-01
299	79	80	1	.992E+00
300	79	223	4	.132E+01
301	79	301	1	.108E+00
302	79	301	1	.870E-01
303	80	81	1	.108E+01
304	80	224	4	.160E+01
305	80	301	1	.930E-01
306	80	301	1	.910E-01
307	81	82	1	.146E+01
308	81	225	4	.114E+01
309	81	301	1	.840E-01
310	81	301	1	.830E-01
311	82	83	1	.146E+01
312	82	226	4	.114E+01
313	82	301	1	.850E-01
314	82	301	1	.820E-01
315	83	84	1	.146E+01
316	83	227	4	.114E+01
317	83	301	1	.850E-01
318	83	301	1	.820E-01
319	84	85	1	.146E+01
320	84	228	4	.114E+01
321	84	301	1	.860E-01
322	84	301	1	.820E-01
323	85	86	1	.146E+01
324	85	229	4	.114E+01
325	85	301	1	.860E-01
326	85	301	1	.820E-01
327	86	87	1	.146E+01
328	86	230	4	.114E+01
329	86	301	1	.860E-01
330	86	301	1	.820E-01
331	87	88	1	.146E+01
332	87	231	4	.114E+01
333	87	301	1	.860E-01
334	87	301	1	.820E-01
335	88	89	1	.146E+01
336	88	232	4	.114E+01

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
337	88	301	1	.850E-01	393	102	301	1	.900E-01	449	116	301	1	.830E-01
338	88	301	1	.820E-01	394	103	104	1	.146E+01	450	117	118	1	.146E+01
339	89	90	1	.146E+01	395	103	247	4	.114E+01	451	117	261	4	.114E+01
340	89	233	4	.114E+01	396	103	301	1	.760E-01	452	117	301	1	.830E-01
341	89	301	1	.850E-01	397	103	301	1	.840E-01	453	117	301	1	.830E-01
342	89	301	1	.810E-01	398	104	105	1	.146E+01	454	118	119	1	.129E+01
343	90	91	1	.146E+01	399	104	248	4	.114E+01	455	118	262	4	.114E+01
344	90	234	4	.114E+01	400	104	301	1	.780E-01	456	118	301	1	.820E-01
345	90	301	1	.850E-01	401	104	301	1	.840E-01	457	118	301	1	.840E-01
346	90	301	1	.810E-01	402	105	106	1	.146E+01	458	119	120	1	.115E+01
347	91	92	1	.146E+01	403	105	249	4	.114E+01	459	119	263	4	.144E+01
348	91	235	4	.114E+01	404	105	301	1	.790E-01	460	119	301	1	.860E-01
349	91	301	1	.850E-01	405	105	301	1	.830E-01	461	119	301	1	.960E-01
350	91	301	1	.810E-01	406	106	107	1	.146E+01	462	120	121	1	.115E+01
351	92	93	1	.146E+01	407	106	250	4	.114E+01	463	120	264	4	.144E+01
352	92	236	4	.114E+01	408	106	301	1	.810E-01	464	120	301	1	.650E-01
353	92	301	1	.850E-01	409	106	301	1	.830E-01	465	120	301	1	.113E+00
354	92	301	1	.810E-01	410	107	108	1	.146E+01	466	121	122	1	.115E+01
355	93	94	1	.146E+01	411	107	251	4	.114E+01	467	121	265	4	.144E+01
356	93	237	4	.114E+01	412	107	301	1	.820E-01	468	121	301	1	.220E-01
357	93	301	1	.850E-01	413	107	301	1	.830E-01	469	121	301	1	.133E+00
358	93	301	1	.810E-01	414	108	109	1	.146E+01	470	122	123	1	.115E+01
359	94	95	1	.146E+01	415	108	252	4	.114E+01	471	122	266	4	.144E+01
360	94	238	4	.114E+01	416	108	301	1	.840E-01	472	122	301	1	.420E-01
361	94	301	1	.850E-01	417	108	301	1	.830E-01	473	123	124	1	.115E+01
362	94	301	1	.810E-01	418	109	110	1	.146E+01	474	123	267	4	.144E+01
363	95	96	1	.146E+01	419	109	253	4	.114E+01	475	123	301	1	.760E-01
364	95	239	4	.114E+01	420	109	301	1	.850E-01	476	124	125	1	.129E+01
365	95	301	1	.850E-01	421	109	301	1	.830E-01	477	124	268	4	.144E+01
366	95	301	1	.810E-01	422	110	111	1	.146E+01	478	124	301	1	.940E-01
367	96	97	1	.129E+01	423	110	254	4	.114E+01	479	125	126	1	.146E+01
368	96	240	4	.114E+01	424	110	301	1	.850E-01	480	125	269	4	.114E+01
369	96	301	1	.840E-01	425	110	301	1	.830E-01	481	125	301	1	.490E-01
370	96	301	1	.800E-01	426	111	112	1	.146E+01	482	125	301	1	.860E-01
371	97	98	1	.115E+01	427	111	255	4	.114E+01	483	126	127	1	.146E+01
372	97	241	4	.144E+01	428	111	301	1	.850E-01	484	126	270	4	.114E+01
373	97	301	1	.900E-01	429	111	301	1	.830E-01	485	126	301	1	.680E-01
374	97	301	1	.930E-01	430	112	113	1	.146E+01	486	126	301	1	.860E-01
375	98	99	1	.115E+01	431	112	256	4	.114E+01	487	127	128	1	.146E+01
376	98	242	4	.144E+01	432	112	301	1	.850E-01	488	127	271	4	.114E+01
377	98	301	1	.690E-01	433	112	301	1	.830E-01	489	127	301	1	.820E-01
378	98	301	1	.123E+00	434	113	114	1	.146E+01	490	127	301	1	.850E-01
379	99	100	1	.115E+01	435	113	257	4	.114E+01	491	128	129	1	.146E+01
380	99	243	4	.144E+01	436	113	301	1	.850E-01	492	128	272	4	.114E+01
381	99	301	1	.260E-01	437	113	301	1	.830E-01	493	128	301	1	.910E-01
382	99	301	1	.149E+00	438	114	115	1	.146E+01	494	128	301	1	.840E-01
383	100	101	1	.115E+01	439	114	258	4	.114E+01	495	129	130	1	.146E+01
384	100	244	4	.144E+01	440	114	301	1	.850E-01	496	129	273	4	.114E+01
385	100	301	1	.380E-01	441	114	301	1	.830E-01	497	129	301	1	.970E-01
386	101	102	1	.115E+01	442	115	116	1	.146E+01	498	129	301	1	.830E-01
387	101	245	4	.144E+01	443	115	259	4	.114E+01	499	130	131	1	.146E+01
388	101	301	1	.920E-01	444	115	301	1	.840E-01	500	130	274	4	.114E+01
389	101	301	1	.720E-01	445	115	301	1	.830E-01	501	130	301	1	.100E+00
390	102	103	1	.129E+01	446	116	117	1	.146E+01	502	130	301	1	.830E-01
391	102	246	4	.144E+01	447	116	260	4	.114E+01	503	131	132	1	.146E+01
392	102	301	1	.124E+00	448	116	301	1	.840E-01	504	131	275	4	.114E+01

Brnh	From	To	Tag	Conduct
505	131	301	1	.101E+00
506	131	301	1	.830E-01
507	132	133	1	.146E+01
508	132	276	4	.114E+01
509	132	301	1	.100E+00
510	132	301	1	.830E-01
511	133	134	1	.146E+01
512	133	277	4	.114E+01
513	133	301	1	.970E-01
514	133	301	1	.830E-01
515	134	135	1	.146E+01
516	134	278	4	.114E+01
517	134	301	1	.910E-01
518	134	301	1	.840E-01
519	135	136	1	.146E+01
520	135	279	4	.114E+01
521	135	301	1	.820E-01
522	135	301	1	.840E-01
523	136	137	1	.146E+01
524	136	280	4	.114E+01
525	136	301	1	.680E-01
526	136	301	1	.860E-01
527	137	138	1	.146E+01
528	137	281	4	.114E+01
529	137	301	1	.490E-01
530	137	301	1	.870E-01
531	138	139	1	.146E+01
532	138	282	4	.114E+01
533	138	301	1	.240E-01
534	138	301	1	.880E-01
535	139	140	1	.146E+01
536	139	283	4	.114E+01
537	139	301	1	.900E-01
538	140	141	1	.160E+01
539	140	284	4	.114E+01
540	140	301	1	.910E-01
541	141	142	1	.178E+01
542	141	285	4	.933E+00
543	142	143	1	.178E+01
544	142	286	4	.933E+00
545	143	144	1	.178E+01
546	143	287	4	.933E+00
547	144	288	4	.933E+00
548	145	302	5	.316E+03
549	146	145	5	.316E+03
550	147	146	5	.316E+03
551	148	147	5	.316E+03
552	149	148	5	.316E+03
553	150	149	5	.316E+03
554	151	150	5	.316E+03
555	152	151	5	.316E+03
556	153	152	5	.316E+03
557	154	153	5	.316E+03
558	155	154	5	.316E+03
559	156	155	5	.316E+03
560	157	156	5	.316E+03

Brnh	From	To	Tag	Conduct
561	158	157	5	.316E+03
562	159	158	5	.316E+03
563	160	159	5	.316E+03
564	161	160	5	.316E+03
565	162	161	5	.316E+03
566	163	162	5	.316E+03
567	164	163	5	.316E+03
568	165	164	5	.316E+03
569	166	165	5	.316E+03
570	167	166	5	.316E+03
571	168	167	5	.316E+03
572	169	168	5	.316E+03
573	170	169	5	.316E+03
574	171	170	5	.316E+03
575	172	171	5	.316E+03
576	173	172	5	.316E+03
577	174	173	5	.316E+03
578	175	174	5	.316E+03
579	176	175	5	.316E+03
580	177	176	5	.316E+03
581	178	177	5	.316E+03
582	179	178	5	.316E+03
583	180	179	5	.316E+03
584	181	180	5	.316E+03
585	182	181	5	.316E+03
586	183	182	5	.316E+03
587	184	183	5	.316E+03
588	185	184	5	.316E+03
589	186	185	5	.316E+03
590	187	186	5	.316E+03
591	188	187	5	.316E+03
592	189	188	5	.316E+03
593	190	189	5	.316E+03
594	191	190	5	.316E+03
595	192	191	5	.316E+03
596	193	192	5	.316E+03
597	194	193	5	.316E+03
598	195	194	5	.316E+03
599	196	195	5	.316E+03
600	197	196	5	.316E+03
601	198	197	5	.316E+03
602	199	198	5	.316E+03
603	200	199	5	.316E+03
604	201	200	5	.316E+03
605	202	201	5	.316E+03
606	203	202	5	.316E+03
607	204	203	5	.316E+03
608	205	204	5	.316E+03
609	206	205	5	.316E+03
610	207	206	5	.316E+03
611	208	207	5	.316E+03
612	209	208	5	.316E+03
613	210	209	5	.316E+03
614	211	210	5	.316E+03
615	212	211	5	.316E+03
616	213	212	5	.316E+03

Brnh	From	To	Tag	Conduct
617	214	213	5	.316E+03
618	215	214	5	.316E+03
619	216	215	5	.316E+03
620	217	216	5	.316E+03
621	218	217	5	.316E+03
622	219	218	5	.316E+03
623	220	219	5	.316E+03
624	221	220	5	.316E+03
625	222	221	5	.316E+03
626	223	222	5	.316E+03
627	224	223	5	.316E+03
628	225	224	5	.316E+03
629	226	225	5	.316E+03
630	227	226	5	.316E+03
631	228	227	5	.316E+03
632	229	228	5	.316E+03
633	230	229	5	.316E+03
634	231	230	5	.316E+03
635	232	231	5	.316E+03
636	233	232	5	.316E+03
637	234	233	5	.316E+03
638	235	234	5	.316E+03
639	236	235	5	.316E+03
640	237	236	5	.316E+03
641	238	237	5	.316E+03
642	239	238	5	.316E+03
643	240	239	5	.316E+03
644	241	240	5	.316E+03
645	242	241	5	.316E+03
646	243	242	5	.316E+03
647	244	243	5	.316E+03
648	245	244	5	.316E+03
649	246	245	5	.316E+03
650	247	246	5	.316E+03
651	248	247	5	.316E+03
652	249	248	5	.316E+03
653	250	249	5	.316E+03
654	251	250	5	.316E+03
655	252	251	5	.316E+03
656	253	252	5	.316E+03
657	254	253	5	.316E+03
658	255	254	5	.316E+03
659	256	255	5	.316E+03
660	257	256	5	.316E+03
661	258	257	5	.316E+03
662	259	258	5	.316E+03
663	260	259	5	.316E+03
664	261	260	5	.316E+03
665	262	261	5	.316E+03
666	263	262	5	.316E+03
667	264	263	5	.316E+03
668	265	264	5	.316E+03
669	266	265	5	.316E+03
670	267	266	5	.316E+03
671	268	267	5	.316E+03
672	269	268	5	.316E+03

Brnh	From	To	Tag	Conduct
673	270	269	5	.316E+03
674	271	270	5	.316E+03
675	272	271	5	.316E+03
676	273	272	5	.316E+03
677	274	273	5	.316E+03
678	275	274	5	.316E+03
679	276	275	5	.316E+03
680	277	276	5	.316E+03
681	278	277	5	.316E+03
682	279	278	5	.316E+03
683	280	279	5	.316E+03
684	281	280	5	.316E+03
685	282	281	5	.316E+03
686	283	282	5	.316E+03
687	284	283	5	.316E+03
688	285	284	5	.316E+03
689	286	285	5	.316E+03
690	287	286	5	.316E+03
691	288	287	5	.316E+03

TASS GENERAL INPUT MENU - SI Units

(1) Case Title:
TALSR(METRIC)--RUN 5. COMPLEX MODEL, MASS FLOW OF 362.9 kg/hr (800 lbm/hr)

(2)	Nodes	288
(3)	Constant Temperatures	2
(4)	Unique Exponents	0
(5)	Temperature Dependent Conductances	0
(6)	Temperature Dependent Heat Inputs	0
(7)	Computational Accuracy	.0100
(8)	Starting Temperature	25.0

Are these inputs correct (Y/N) ? Y

INPUT DATA

Fin Length (L) (cm)	Fin Thickness (cm)	Fin spacing (z) (cm)	Thermal Conductivity of Copper (λ) (W/cm K)	Reynolds Number	Prandtl Number	Outer pipe diameter (cm)	Inner pipe diameter (cm)	Pipe Area (sq. cm)
0.318	0.016	0.0533	4.01	1900.00	0.707	0.635	0.483	0.134

K-Value	Channel Width (b) (cm)	Effective Diameter (cm)	Heat Transfer Coefficient (h) (W/sq.cm K)	b-Term (cm)	Yin f (W/K)	Dist. between Nodes (cm)	Fins/node	K - Value (W/K)
K1			N/A			0.302	N/A	1.7784
K2			2.560			0.302	N/A	1.1707
K3			N/A			0.334	N/A	1.6043
K4			N/A			0.367	N/A	1.4612
K5			2.560			0.367	N/A	1.4249
K6	1.143	0.1019	0.03628	0.68200	0.01333	0.367	6.880	0.0854
K7	1.143	0.1019	0.03628	0.66800	0.01314	0.367	6.880	0.0840
K8	1.143	0.1019	0.03628	0.65200	0.01291	0.367	6.880	0.0824
K9	0.094	0.0661	0.04748		0.00282	0.367	6.880	0.0241
K10	1.143	0.1019	0.03628	0.63500	0.01268	0.367	6.880	0.0807
K11	0.269	0.0890	0.03967		0.00658	0.367	6.880	0.0492
K12	1.143	0.1019	0.03628	0.62100	0.01245	0.367	6.880	0.0893
K13	0.414	0.0946	0.03813		0.00937	0.367	6.880	0.0682
K14	1.143	0.1019	0.03628	0.60800	0.01226	0.367	6.880	0.0879
K15	0.631	0.0980	0.03749		0.01138	0.367	6.880	0.0819
K16	1.143	0.1019	0.03628	0.69800	0.01210	0.367	6.880	0.0869
K17	0.620	0.0982	0.03718		0.01271	0.367	6.880	0.0911
K18	1.143	0.1019	0.03628	0.69000	0.01196	0.367	6.880	0.0860
K19	0.681	0.0989	0.03698		0.01354	0.367	6.880	0.0969
K20	1.143	0.1019	0.03628	0.68400	0.01188	0.367	6.880	0.0854
K21	0.718	0.0993	0.03600		0.01400	0.367	6.880	0.1000
K22	1.143	0.1019	0.03628	0.68100	0.01184	0.367	6.880	0.0850
K23	0.732	0.0994	0.03668		0.01419	0.367	6.880	0.1013
K24	1.143	0.1019	0.03628	0.68100	0.01184	0.367	6.880	0.0850
K25	1.143	0.1019	0.03628	0.68100	0.01184	0.367	6.880	0.0850
K26	1.143	0.1019	0.03628	0.68500	0.01190	0.367	6.880	0.0855
K27	1.143	0.1019	0.03628	0.69000	0.01196	0.367	6.880	0.0860
K28	1.143	0.1019	0.03628	0.69600	0.01207	0.367	6.880	0.0867
K29			N/A			0.416	N/A	1.2007
K30	1.143	0.1019	0.03628	0.60200	0.01216	0.367	6.880	0.0873
K31			N/A			0.465	N/A	1.1524
K32			2.560			0.465	N/A	1.8067
K33	1.104	0.1018	0.03629	0.69000	0.01199	0.465	7.540	0.0944
K34	0.808	0.1001	0.03670	0.44800	0.00968	0.465	7.540	0.0770
K35	0.298	0.0904	0.03928	0.20300	0.00498	0.465	7.540	0.0419
K36	2.037	0.1040	0.03678	1.10100	0.01745	0.465	7.540	0.1365
K37	0.298	0.0904	0.03928	0.09300	0.00231	0.465	7.540	0.0218
K38	1.498	0.1030	0.03600	0.82200	0.01601	0.465	7.540	0.1171
K39	0.808	0.1001	0.03670	0.30000	0.00798	0.465	7.540	0.0642
K40	1.164	0.1021	0.03622	0.65100	0.01208	0.465	7.540	0.1012
K41	1.104	0.1018	0.03629	0.61400	0.01076	0.466	7.540	0.0850

K42	1.143	0.1019	0.03628	0.61600	0.01241	0.367	6.880	0.0890
K43	1.143	0.1019	0.03628	0.64100	0.01119	0.367	6.880	0.0808
K44	1.143	0.1019	0.03628	0.61000	0.01229	0.367	6.880	0.0881
K45	1.143	0.1019	0.03628	0.54700	0.01129	0.367	6.880	0.0813
K46	1.143	0.1019	0.03628	0.60300	0.01218	0.367	6.880	0.0874
K47	1.143	0.1019	0.03628	0.55300	0.01139	0.367	6.880	0.0820
K48	1.143	0.1019	0.03628	0.59600	0.01210	0.367	6.880	0.0869
K49	1.143	0.1019	0.03628	0.55500	0.01147	0.367	6.880	0.0826
K50	1.143	0.1019	0.03628	0.58500	0.01206	0.367	6.880	0.0866
K51	1.143	0.1019	0.03628	0.56200	0.01153	0.367	6.880	0.0830
K52	1.143	0.1019	0.03628	0.59200	0.01201	0.367	6.880	0.0862
K53	1.143	0.1019	0.03628	0.56200	0.01163	0.367	6.880	0.0830
K54	1.143	0.1019	0.03628	0.59000	0.01198	0.367	6.880	0.0860
K55	1.143	0.1019	0.03628	0.56200	0.01163	0.367	6.880	0.0830
K56	1.143	0.1019	0.03628	0.58900	0.01196	0.367	6.880	0.0859
K57	1.143	0.1019	0.03628	0.55900	0.01148	0.367	6.880	0.0828
K58	1.143	0.1019	0.03628	0.58600	0.01192	0.367	6.880	0.0856
K59	1.143	0.1019	0.03628	0.55300	0.01139	0.367	6.880	0.0820
K60	1.143	0.1019	0.03628	0.58500	0.01190	0.367	6.880	0.0856
K61	1.143	0.1019	0.03628	0.54600	0.01128	0.367	6.880	0.0810
K62	1.143	0.1019	0.03628	0.58400	0.01188	0.367	6.880	0.0854
K63	1.143	0.1019	0.03628	0.53500	0.01109	0.367	6.880	0.0799
K64	1.143	0.1019	0.03628	0.58200	0.01185	0.367	6.880	0.0852
K65	1.143	0.1019	0.03628	0.52200	0.01087	0.367	6.880	0.0784
K66	1.143	0.1019	0.03628	0.58100	0.01184	0.367	6.880	0.0850
K67	1.143	0.1019	0.03628	0.50600	0.01063	0.367	6.880	0.0768
K68	1.143	0.1019	0.03628	0.58000	0.01182	0.367	6.880	0.0849
K69	1.143	0.1019	0.03628	0.49100	0.01034	0.367	6.880	0.0747
K70	1.143	0.1019	0.03628	0.57800	0.01179	0.367	6.880	0.0847
K71	1.143	0.1019	0.03628	0.47500	0.01005	0.367	6.880	0.0726
K72	1.143	0.1019	0.03628	0.57800	0.01179	0.367	6.880	0.0847
K73	1.143	0.1019	0.03628	0.48100	0.00980	0.367	6.880	0.0711
K74	1.104	0.1018	0.03629	0.65900	0.01160	0.465	7.640	0.0867
K75	0.888	0.1008	0.03667		0.01691	0.465	7.640	0.1240
K76	0.808	0.1001	0.03670	0.41800	0.00911	0.465	7.640	0.0728
K77	0.650	0.0973	0.03741		0.01167	0.465	7.640	0.0921
K78	0.298	0.0904	0.03928	0.18500	0.00455	0.465	7.640	0.0386
K79	2.931	0.1048	0.03560	1.48800	0.01932	0.465	7.640	0.1498
K80	0.298	0.0904	0.03928	0.11100	0.00275	0.465	7.640	0.0251
K81	1.850	0.1037	0.03684	0.86000	0.01626	0.465	7.640	0.1265
K82	0.808	0.1001	0.03670	0.39000	0.00857	0.465	7.640	0.0687
K83	1.226	0.1022	0.03618	0.84600	0.01279	0.465	7.640	0.1004
K84	1.104	0.1018	0.03629	0.64500	0.01127	0.465	7.640	0.0860
K85	1.143	0.1019	0.03628	0.60400	0.01220	0.367	6.880	0.0876
K86	1.143	0.1019	0.03628	0.56600	0.01158	0.367	6.880	0.0833
K87	1.143	0.1019	0.03628	0.60300	0.01218	0.367	6.880	0.0874
K88	1.143	0.1019	0.03628	0.56600	0.01168	0.367	6.880	0.0833
K89	1.143	0.1019	0.03628	0.60200	0.01218	0.367	6.880	0.0873
K90	1.143	0.1019	0.03628	0.56300	0.01165	0.367	6.880	0.0831
K91	1.143	0.1019	0.03628	0.60000	0.01213	0.367	6.880	0.0871
K92	1.143	0.1019	0.03628	0.56200	0.01163	0.367	6.880	0.0830
K93	1.143	0.1019	0.03628	0.59900	0.01212	0.367	6.880	0.0870

K94	1.143	0.1019	0.03626	0.56100	0.01152	0.367	6.880	0.0828
K95	1.143	0.1019	0.03626	0.59800	0.01210	0.367	6.880	0.0869
K96	1.143	0.1019	0.03626	0.55900	0.01148	0.367	6.880	0.0828
K97	1.143	0.1019	0.03626	0.59600	0.01207	0.367	6.880	0.0867
K98	1.143	0.1019	0.03626	0.55800	0.01147	0.367	6.880	0.0825
K99	1.143	0.1019	0.03626	0.59500	0.01206	0.367	6.880	0.0866
K100	1.143	0.1019	0.03626	0.55700	0.01145	0.367	6.880	0.0824
K101	1.143	0.1019	0.03626	0.59400	0.01204	0.367	6.880	0.0864
K102	1.143	0.1019	0.03626	0.55400	0.01140	0.367	6.880	0.0821
K103	1.143	0.1019	0.03626	0.59300	0.01202	0.367	6.880	0.0863
K104	1.143	0.1019	0.03626	0.55300	0.01139	0.367	6.880	0.0820
K105	1.143	0.1019	0.03626	0.59200	0.01201	0.367	6.880	0.0862
K106	1.143	0.1019	0.03626	0.55100	0.01135	0.367	6.880	0.0817
K107	1.143	0.1019	0.03626	0.59000	0.01198	0.367	6.880	0.0860
K108	1.143	0.1019	0.03626	0.54800	0.01130	0.367	6.880	0.0814
K109	1.143	0.1019	0.03626	0.58900	0.01196	0.367	6.880	0.0859
K110	1.143	0.1019	0.03626	0.54500	0.01126	0.367	6.880	0.0810
K111	1.143	0.1019	0.03626	0.58700	0.01193	0.367	6.880	0.0857
K112	1.143	0.1019	0.03626	0.54000	0.01117	0.367	6.880	0.0805
K113	1.143	0.1019	0.03626	0.58600	0.01192	0.367	6.880	0.0856
K114	1.143	0.1019	0.03626	0.53300	0.01106	0.367	6.880	0.0797
K115			N/A			0.496	N/A	1.0819
K116	1.143	0.1019	0.03626	0.58500	0.01190	0.367	6.880	0.0855
K117	1.143	0.1019	0.03626	0.52500	0.01092	0.367	6.880	0.0788
K118			N/A			0.541	N/A	0.992
K119			1.260			0.518	N/A	0.990
K120	1.143	0.1019	0.03626	0.58300	0.01187	0.541	7.540	0.0935
K121	1.184	0.1021	0.03622	0.53400	0.01106	0.541	7.540	0.0874
K122			N/A			0.312	N/A	1.717
K123			1.260			0.427	N/A	0.815
K124	1.143	0.1019	0.03626	0.58100	0.01184	0.312	7.540	0.0933
K125	1.498	0.1030	0.03600	0.67400	0.01314	0.312	7.540	0.1031
K126			N/A			0.255	N/A	2.100
K127			1.260			0.284	N/A	0.542
K128	1.143	0.1019	0.03626	0.58000	0.01182	0.255	7.540	0.0931
K129	2.037	0.1040	0.03578	0.93600	0.01610	0.255	7.540	0.1254
K130			N/A			0.429	N/A	1.251
K131			1.260			0.343	N/A	0.655
K132	1.143	0.1019	0.03626	0.57900	0.01181	0.429	8.040	0.0992
K133	2.907	0.10476	0.03560		0.02088	0.429	8.040	0.1720
K134			N/A			0.447	N/A	1.200
K135	1.143	0.1019	0.03626	0.57600	0.01176	0.429	8.040	0.0989
K136	2.482	0.10444	0.03567		0.02077	0.429	8.040	0.1712
K137	1.104	0.1018	0.03629	0.56600	0.01143	0.465	7.640	0.0902
K138	1.840	0.10368	0.03685		0.02025	0.465	7.640	0.1567
K139	0.808	0.1001	0.03670	0.40700	0.00890	0.465	7.540	0.0712
K140	1.119	0.10182	0.03628		0.01776	0.465	7.540	0.1378
K141	0.298	0.0904	0.03928	0.15100	0.00373	0.465	7.640	0.0325
K142	0.359	0.09288	0.03867		0.00834	0.465	7.640	0.0672
K143	0.298	0.0904	0.03928	0.14500	0.00368	0.465	7.540	0.0314
K144	0.808	0.1001	0.03670	0.40100	0.00879	0.465	7.640	0.0703
K145	1.104	0.1018	0.03629	0.54900	0.01133	0.465	7.540	0.0895

K146	1.143	0.1019	0.03628	0.66700	0.01161	0.420	8.040	0.0977
K147	1.143	0.1019	0.03628	0.66400	0.01157	0.420	8.040	0.0973
K148	2.032	0.1040	0.03578	0.87600	0.01647	0.255	7.640	0.1242
K149	1.143	0.1019	0.03628	0.66300	0.01155	0.255	7.640	0.0911
K150	1.408	0.1030	0.03600	0.71000	0.01375	0.312	7.640	0.1077
K151	1.143	0.1019	0.03628	0.66200	0.01153	0.312	7.640	0.0870
K152	1.164	0.1021	0.03622	0.66200	0.01164	0.641	7.640	0.0853
K153	1.143	0.1019	0.03628	0.66000	0.01150	0.641	7.640	0.0867
K154	1.143	0.1019	0.03628	0.57300	0.01171	0.367	8.000	0.0842
K155	1.143	0.1019	0.03628	0.55800	0.01147	0.367	8.000	0.0826
K156	1.143	0.1019	0.03628	0.67000	0.01161	0.367	8.000	0.0846
K157	1.143	0.1019	0.03628	0.65700	0.01145	0.367	8.000	0.0824
K158	1.143	0.1019	0.03628	0.68200	0.01185	0.367	8.000	0.0852
K159	1.143	0.1019	0.03628	0.55600	0.01144	0.367	8.000	0.0823
K160	1.143	0.1019	0.03628	0.68500	0.01190	0.367	8.000	0.0855
K161	1.143	0.1019	0.03628	0.65400	0.01140	0.367	8.000	0.0821
K162	1.143	0.1019	0.03628	0.68600	0.01190	0.367	8.000	0.0855
K163	1.143	0.1019	0.03628	0.65300	0.01139	0.367	8.000	0.0820
K164	1.143	0.1019	0.03628	0.68400	0.01190	0.367	8.000	0.0855
K165	1.143	0.1019	0.03628	0.65100	0.01135	0.367	8.000	0.0817
K166	1.143	0.1019	0.03628	0.68200	0.01180	0.367	8.000	0.0855
K167	1.143	0.1019	0.03628	0.65000	0.01134	0.367	8.000	0.0818
K168	1.143	0.1019	0.03628	0.68400	0.01166	0.367	8.000	0.0864
K169	1.143	0.1019	0.03628	0.64900	0.01132	0.367	8.000	0.0816
K170	1.143	0.1019	0.03628	0.68400	0.01168	0.367	8.000	0.0854
K171	1.143	0.1019	0.03628	0.64600	0.01130	0.367	8.000	0.0814
K172	1.143	0.1019	0.03628	0.68300	0.01187	0.367	8.000	0.0853
K173	1.143	0.1019	0.03628	0.64700	0.01128	0.367	8.000	0.0813
K174	1.143	0.1019	0.03628	0.68200	0.01185	0.367	8.000	0.0862
K175	1.143	0.1019	0.03628	0.64600	0.01126	0.367	8.000	0.0810
K176	1.143	0.1019	0.03628	0.68100	0.01184	0.367	8.000	0.0850
K177	1.143	0.1019	0.03628	0.64400	0.01124	0.367	8.000	0.0808
K178	1.143	0.1019	0.03628	0.68000	0.01182	0.367	8.000	0.0849
K179	1.143	0.1019	0.03628	0.64300	0.01122	0.367	8.000	0.0806
K180	1.143	0.1019	0.03628	0.67700	0.01177	0.367	8.000	0.0848
K181	1.143	0.1019	0.03628	0.64100	0.01118	0.367	8.000	0.0806
K182	1.143	0.1019	0.03628	0.67600	0.01176	0.367	8.000	0.0846
K183	1.143	0.1019	0.03628	0.64000	0.01117	0.367	8.000	0.0806
K184	1.143	0.1019	0.03628	0.67600	0.01174	0.367	8.000	0.0844
K185	1.143	0.1019	0.03628	0.63800	0.01116	0.367	8.000	0.0804
K186	1.164	0.1018	0.03628	0.65300	0.01140	0.465	7.640	0.0800
K187	1.226	0.1022	0.03618	0.66000	0.01160	0.465	7.640	0.0830
K188	0.666	0.1001	0.03670	0.38600	0.00667	0.465	7.640	0.0604
K189	1.650	0.1037	0.03584	0.86000	0.01577	0.465	7.640	0.1220
K190	0.250	0.0984	0.03826	0.11000	0.00266	0.465	7.640	0.0260
K191	2.031	0.1048	0.03560	1.44400	0.01617	0.465	7.640	0.1405
K192	0.200	0.0984	0.03828	0.16000	0.00443	0.465	7.640	0.0377
K193	0.666	0.1001	0.03670	0.41300	0.00602	0.465	7.640	0.0721
K194	1.164	0.1018	0.03628	0.65100	0.01130	0.465	7.640	0.0837
K195	1.143	0.1019	0.03628	0.60400	0.01060	0.367	8.000	0.0763
K196	1.143	0.1019	0.03628	0.64000	0.01103	0.367	8.000	0.0836
K197	1.143	0.1019	0.03628	0.61700	0.01070	0.367	8.000	0.0776

K198	1.143	0.1019	0.03626	0.56700	0.01161	0.367	6.000	0.0835
K199	1.143	0.1019	0.03626	0.53100	0.01102	0.367	6.000	0.0794
K200	1.143	0.1019	0.03626	0.55600	0.01100	0.367	6.000	0.0834
K201	1.143	0.1019	0.03626	0.54400	0.01124	0.367	6.000	0.0809
K202	1.143	0.1019	0.03626	0.56300	0.01165	0.367	6.000	0.0831
K203	1.143	0.1019	0.03626	0.65700	0.01145	0.367	6.000	0.0824
K204	1.143	0.1019	0.03626	0.66200	0.01153	0.367	6.000	0.0830
K205	1.143	0.1019	0.03626	0.56600	0.01163	0.367	6.000	0.0836
K206	1.143	0.1019	0.03626	0.66100	0.01152	0.367	6.000	0.0828
K207	1.143	0.1019	0.03626	0.67000	0.01176	0.367	6.000	0.0846
K208	1.143	0.1019	0.03626	0.66000	0.01160	0.367	6.000	0.0827
K209	1.143	0.1019	0.03626	0.66100	0.01164	0.367	6.000	0.0850
K210	1.143	0.1019	0.03626	0.65000	0.01148	0.367	6.000	0.0826
K211	1.143	0.1019	0.03626	0.68400	0.01168	0.367	6.000	0.0854
K212	1.143	0.1019	0.03626	0.65900	0.01148	0.367	6.000	0.0826
K213	1.143	0.1019	0.03626	0.66100	0.01168	0.367	6.000	0.0854
K214	1.143	0.1019	0.03626	0.65000	0.01147	0.367	6.000	0.0825
K215	1.143	0.1019	0.03626	0.66300	0.01167	0.367	6.000	0.0853
K216	1.143	0.1019	0.03626	0.65000	0.01147	0.367	6.000	0.0825
K217	1.143	0.1019	0.03626	0.66000	0.01162	0.367	6.000	0.0819
K218	1.143	0.1019	0.03626	0.66000	0.01147	0.367	6.000	0.0826
K219	1.143	0.1019	0.03626	0.67400	0.01173	0.367	6.000	0.0813
K220	1.143	0.1019	0.03626	0.66000	0.01147	0.367	6.000	0.0826
K221	1.143	0.1019	0.03626	0.66700	0.01161	0.367	6.000	0.0835
K222	1.143	0.1019	0.03626	0.66100	0.01152	0.367	6.000	0.0828
K223	1.143	0.1019	0.03626	0.65000	0.01147	0.367	6.000	0.0825
K224	1.143	0.1019	0.03626	0.66400	0.01167	0.367	6.000	0.0852
K225	1.143	0.1019	0.03626	0.65000	0.01134	0.367	6.000	0.0818
K226	1.143	0.1019	0.03626	0.57000	0.01100	0.367	6.000	0.0838
K227	1.104	0.1018	0.03629	0.62200	0.01068	0.465	7.540	0.0801
K228	1.104	0.1021	0.03622	0.60200	0.01216	0.465	7.540	0.0958
K229	0.808	0.1001	0.03670	0.36500	0.00608	0.465	7.540	0.0650
K230	1.490	0.1030	0.03600	0.77600	0.01449	0.465	7.540	0.1133
K231	0.298	0.0904	0.03926	0.09400	0.00234	0.465	7.540	0.0220
K232	2.037	0.1010	0.03578	1.00100	0.01718	0.465	7.540	0.1333
K233	0.298	0.0904	0.03926	0.20200	0.00485	0.465	7.540	0.0417
K234	0.808	0.1001	0.03670	0.44300	0.00958	0.465	7.540	0.0763
K235	1.104	0.1018	0.03629	0.68200	0.01168	0.465	7.540	0.0836
K236	1.143	0.1019	0.03626	0.69300	0.01202	0.367	6.000	0.0803
K237	1.143	0.1019	0.03626	0.68500	0.01190	0.367	6.000	0.0865
K238	1.143	0.1019	0.03626	0.67600	0.01178	0.367	6.000	0.0845
K239	1.143	0.1019	0.03626	0.66000	0.01165	0.367	6.000	0.0837
K240	1.143	0.1019	0.03626	0.66300	0.01165	0.367	6.000	0.0831
K241	1.143	0.1019	0.03626	0.66000	0.01160	0.367	6.000	0.0827
K242	1.143	0.1019	0.03626	0.65000	0.01148	0.367	6.000	0.0826
K243	1.143	0.1019	0.03626	0.65000	0.01148	0.367	6.000	0.0828
K244	1.143	0.1019	0.03626	0.66200	0.01153	0.367	6.000	0.0830
K245	1.143	0.1019	0.03626	0.66700	0.01161	0.367	6.000	0.0836
K246	1.143	0.1019	0.03626	0.67600	0.01174	0.367	6.000	0.0844
K247	1.143	0.1019	0.03626	0.66000	0.01162	0.367	6.000	0.0828
K248	1.143	0.1019	0.03626	0.66000	0.01212	0.367	6.000	0.0870
K249	1.143	0.1019	0.03626	0.61200	0.01232	0.367	6.000	0.0864

K250	1.143	0.1019	0.03628	0.62000	0.01253	0.367	6.000	0.0698
K251	1.143	0.1019	0.03628	0.63000	0.01272	0.367	6.000	0.0911
K252	N/A	N/A	N/A	N/A	N/A	N/A	N/A	173.8000

TASS Branch Connection Summary in W/degC or Watts if Tag = 10

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
1	1	2	1	.178E+01	57	17	301	1	.860E-01	113	32	176	4	.701E+00
2	1	145	4	.576E+00	58	17	301	1	.910E-01	114	32	301	1	.860E-01
3	2	3	1	.178E+01	59	18	19	1	.146E+01	115	32	301	1	.830E-01
4	2	146	4	.576E+00	60	18	162	4	.701E+00	116	33	34	1	.146E+01
5	3	4	1	.178E+01	61	18	301	1	.860E-01	117	33	177	4	.701E+00
6	3	147	4	.576E+00	62	18	301	1	.820E-01	118	33	301	1	.860E-01
7	4	5	1	.160E+01	63	19	20	1	.146E+01	119	33	301	1	.830E-01
8	4	148	4	.576E+00	64	19	163	4	.701E+00	120	34	35	1	.146E+01
9	5	6	1	.146E+01	65	19	301	1	.870E-01	121	34	178	4	.701E+00
10	5	149	4	.701E+00	66	19	301	1	.680E-01	122	34	301	1	.860E-01
11	5	301	1	.954E-01	67	20	21	1	.129E+01	123	34	301	1	.830E-01
12	6	7	1	.146E+01	68	20	164	4	.701E+00	124	35	36	1	.146E+01
13	6	150	4	.701E+00	69	20	301	1	.870E-01	125	35	179	4	.701E+00
14	6	301	1	.940E-01	70	20	301	1	.490E-01	126	35	301	1	.860E-01
15	7	8	1	.146E+01	71	21	22	1	.115E+01	127	35	301	1	.820E-01
16	7	151	4	.701E+00	72	21	165	4	.889E+00	128	36	37	1	.146E+01
17	7	301	1	.920E-01	73	21	301	1	.940E-01	129	36	180	4	.701E+00
18	7	301	1	.240E-01	74	22	23	1	.115E+01	130	36	301	1	.860E-01
19	8	9	1	.146E+01	75	22	166	4	.889E+00	131	36	301	1	.810E-01
20	8	152	4	.701E+00	76	22	301	1	.770E-01	132	37	38	1	.146E+01
21	8	301	1	.910E-01	77	23	24	1	.115E+01	133	37	181	4	.701E+00
22	8	301	1	.490E-01	78	23	167	4	.889E+00	134	37	301	1	.850E-01
23	9	10	1	.146E+01	79	23	301	1	.420E-01	135	37	301	1	.800E-01
24	9	153	4	.701E+00	80	24	25	1	.115E+01	136	38	39	1	.146E+01
25	9	301	1	.890E-01	81	24	168	4	.889E+00	137	38	182	4	.701E+00
26	9	301	1	.680E-01	82	24	301	1	.136E+00	138	38	301	1	.850E-01
27	10	11	1	.146E+01	83	24	301	1	.220E-01	139	38	301	1	.780E-01
28	10	154	4	.701E+00	84	25	26	1	.115E+01	140	39	40	1	.146E+01
29	10	301	1	.880E-01	85	25	169	4	.889E+00	141	39	183	4	.701E+00
30	10	301	1	.820E-01	86	25	301	1	.117E+00	142	39	301	1	.850E-01
31	11	12	1	.146E+01	87	25	301	1	.640E-01	143	39	301	1	.770E-01
32	11	155	4	.701E+00	88	26	27	1	.129E+01	144	40	41	1	.146E+01
33	11	301	1	.870E-01	89	26	170	4	.889E+00	145	40	184	4	.701E+00
34	11	301	1	.910E-01	90	26	301	1	.101E+00	146	40	301	1	.850E-01
35	12	13	1	.146E+01	91	26	301	1	.850E-01	147	40	301	1	.750E-01
36	12	156	4	.701E+00	92	27	28	1	.146E+01	148	41	42	1	.146E+01
37	12	301	1	.860E-01	93	27	171	4	.701E+00	149	41	185	4	.701E+00
38	12	301	1	.970E-01	94	27	301	1	.890E-01	150	41	301	1	.850E-01
39	13	14	1	.146E+01	95	27	301	1	.810E-01	151	41	301	1	.730E-01
40	13	157	4	.701E+00	96	28	29	1	.146E+01	152	42	43	1	.129E+01
41	13	301	1	.850E-01	97	28	172	4	.701E+00	153	42	186	4	.701E+00
42	13	301	1	.100E+00	98	28	301	1	.880E-01	154	42	301	1	.850E-01
43	14	15	1	.146E+01	99	28	301	1	.810E-01	155	42	301	1	.710E-01
44	14	158	4	.701E+00	100	29	30	1	.146E+01	156	43	44	1	.115E+01
45	14	301	1	.850E-01	101	29	173	4	.701E+00	157	43	187	4	.889E+00
46	14	301	1	.101E+00	102	29	301	1	.870E-01	158	43	301	1	.910E-01
47	15	16	1	.146E+01	103	29	301	1	.820E-01	159	43	301	1	.124E+00
48	15	159	4	.701E+00	104	30	31	1	.146E+01	160	44	45	1	.115E+01
49	15	301	1	.850E-01	105	30	174	4	.701E+00	161	44	188	4	.889E+00
50	15	301	1	.100E+00	106	30	301	1	.870E-01	162	44	301	1	.730E-01
51	16	17	1	.146E+01	107	30	301	1	.830E-01	163	44	301	1	.920E-01
52	16	160	4	.701E+00	108	31	32	1	.146E+01	164	45	46	1	.115E+01
53	16	301	1	.850E-01	109	31	175	4	.701E+00	165	45	189	4	.889E+00
54	16	301	1	.970E-01	110	31	301	1	.870E-01	166	45	301	1	.390E-01
55	17	18	1	.146E+01	111	31	301	1	.830E-01	167	46	47	1	.115E+01
56	17	161	4	.701E+00	112	32	33	1	.146E+01	168	46	190	4	.889E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
169	46	301	1	.150E+00	225	60	301	1	.860E-01	281	74	301	1	.138E+00
170	46	301	1	.250E-01	226	60	301	1	.810E-01	282	74	301	1	.700E-01
171	47	48	1	.115E+01	227	61	62	1	.146E+01	283	75	76	1	.120E+01
172	47	191	4	.889E+00	228	61	205	4	.701E+00	284	75	219	4	.889E+00
173	47	301	1	.127E+00	229	61	301	1	.860E-01	285	75	301	1	.157E+00
174	47	301	1	.690E-01	230	61	301	1	.810E-01	286	75	301	1	.900E-01
175	48	49	1	.129E+01	231	62	63	1	.146E+01	287	76	77	1	.125E+01
176	48	192	4	.889E+00	232	62	206	4	.701E+00	288	76	220	4	.655E+00
177	48	301	1	.100E+00	233	62	301	1	.860E-01	289	76	301	1	.171E+00
178	48	301	1	.890E-01	234	62	301	1	.810E-01	290	76	301	1	.980E-01
179	49	50	1	.146E+01	235	63	64	1	.146E+01	291	77	78	1	.210E+01
180	49	193	4	.701E+00	236	63	207	4	.701E+00	292	77	221	4	.655E+00
181	49	301	1	.880E-01	237	63	301	1	.860E-01	293	77	301	1	.172E+00
182	49	301	1	.830E-01	238	63	301	1	.800E-01	294	77	301	1	.970E-01
183	50	51	1	.146E+01	239	64	65	1	.108E+01	295	78	79	1	.172E+01
184	50	194	4	.701E+00	240	64	208	4	.701E+00	296	78	222	4	.542E+00
185	50	301	1	.870E-01	241	64	301	1	.860E-01	297	78	301	1	.124E+00
186	50	301	1	.830E-01	242	64	301	1	.790E-01	298	78	301	1	.910E-01
187	51	52	1	.146E+01	243	65	66	1	.992E+00	299	79	80	1	.992E+00
188	51	195	4	.701E+00	244	65	209	4	.990E+00	300	79	223	4	.815E+00
189	51	301	1	.870E-01	245	65	301	1	.940E-01	301	79	301	1	.108E+00
190	51	301	1	.830E-01	246	65	301	1	.870E-01	302	79	301	1	.870E-01
191	52	53	1	.146E+01	247	66	67	1	.172E+01	303	80	81	1	.108E+01
192	52	196	4	.701E+00	248	66	210	4	.815E+00	304	80	224	4	.990E+00
193	52	301	1	.870E-01	249	66	301	1	.930E-01	305	80	301	1	.930E-01
194	52	301	1	.830E-01	250	66	301	1	.103E+00	306	80	301	1	.910E-01
195	53	54	1	.146E+01	251	67	68	1	.210E+01	307	81	82	1	.146E+01
196	53	197	4	.701E+00	252	67	211	4	.542E+00	308	81	225	4	.701E+00
197	53	301	1	.870E-01	253	67	301	1	.930E-01	309	81	301	1	.840E-01
198	53	301	1	.830E-01	254	67	301	1	.125E+00	310	81	301	1	.830E-01
199	54	55	1	.146E+01	255	68	69	1	.125E+01	311	82	83	1	.146E+01
200	54	198	4	.701E+00	256	68	212	4	.655E+00	312	82	226	4	.701E+00
201	54	301	1	.870E-01	257	68	301	1	.990E-01	313	82	301	1	.850E-01
202	54	301	1	.830E-01	258	68	301	1	.172E+00	314	82	301	1	.820E-01
203	55	56	1	.146E+01	259	69	70	1	.120E+01	315	83	84	1	.146E+01
204	55	199	4	.701E+00	260	69	213	4	.655E+00	316	83	227	4	.701E+00
205	55	301	1	.870E-01	261	69	301	1	.990E-01	317	83	301	1	.850E-01
206	55	301	1	.830E-01	262	69	301	1	.171E+00	318	83	301	1	.820E-01
207	56	57	1	.146E+01	263	70	71	1	.115E+01	319	84	85	1	.146E+01
208	56	200	4	.701E+00	264	70	214	4	.889E+00	320	84	228	4	.701E+00
209	56	301	1	.870E-01	265	70	301	1	.900E-01	321	84	301	1	.860E-01
210	56	301	1	.820E-01	266	70	301	1	.157E+00	322	84	301	1	.820E-01
211	57	58	1	.146E+01	267	71	72	1	.115E+01	323	85	86	1	.146E+01
212	57	201	4	.701E+00	268	71	215	4	.889E+00	324	85	229	4	.701E+00
213	57	301	1	.860E-01	269	71	301	1	.710E-01	325	85	301	1	.860E-01
214	57	301	1	.820E-01	270	71	301	1	.138E+00	326	85	301	1	.820E-01
215	58	59	1	.146E+01	271	72	73	1	.115E+01	327	86	87	1	.146E+01
216	58	202	4	.701E+00	272	72	216	4	.889E+00	328	86	230	4	.701E+00
217	58	301	1	.860E-01	273	72	301	1	.330E-01	329	86	301	1	.860E-01
218	58	301	1	.820E-01	274	72	301	1	.670E-01	330	86	301	1	.820E-01
219	59	60	1	.146E+01	275	73	74	1	.115E+01	331	87	88	1	.146E+01
220	59	203	4	.701E+00	276	73	217	4	.889E+00	332	87	231	4	.701E+00
221	59	301	1	.860E-01	277	73	301	1	.670E-01	333	87	301	1	.860E-01
222	59	301	1	.820E-01	278	73	301	1	.310E-01	334	87	301	1	.820E-01
223	60	61	1	.146E+01	279	74	75	1	.115E+01	335	88	89	1	.146E+01
224	60	204	4	.701E+00	280	74	218	4	.889E+00	336	88	232	4	.701E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
337	88	301	1	.850E-01	393	102	301	1	.900E-01	449	116	301	1	.830E-01
338	88	301	1	.820E-01	394	103	104	1	.146E+01	450	117	118	1	.146E+01
339	89	90	1	.146E+01	395	103	247	4	.701E+00	451	117	261	4	.701E+00
340	89	233	4	.701E+00	396	103	301	1	.760E-01	452	117	301	1	.830E-01
341	89	301	1	.850E-01	397	103	301	1	.840E-01	453	117	301	1	.830E-01
342	89	301	1	.810E-01	398	104	105	1	.146E+01	454	118	119	1	.129E+01
343	90	91	1	.146E+01	399	104	248	4	.701E+00	455	118	262	4	.701E+00
344	90	234	4	.701E+00	400	104	301	1	.780E-01	456	118	301	1	.820E-01
345	90	301	1	.850E-01	401	104	301	1	.840E-01	457	118	301	1	.840E-01
346	90	301	1	.810E-01	402	105	106	1	.146E+01	458	119	120	1	.115E+01
347	91	92	1	.146E+01	403	105	249	4	.701E+00	459	119	263	4	.889E+00
348	91	235	4	.701E+00	404	105	301	1	.790E-01	460	119	301	1	.860E-01
349	91	301	1	.850E-01	405	105	301	1	.830E-01	461	119	301	1	.960E-01
350	91	301	1	.810E-01	406	106	107	1	.146E+01	462	120	121	1	.115E+01
351	92	93	1	.146E+01	407	106	250	4	.701E+00	463	120	264	4	.889E+00
352	92	236	4	.701E+00	408	106	301	1	.810E-01	464	120	301	1	.650E-01
353	92	301	1	.850E-01	409	106	301	1	.830E-01	465	120	301	1	.113E+00
354	92	301	1	.810E-01	410	107	108	1	.146E+01	466	121	122	1	.115E+01
355	93	94	1	.146E+01	411	107	251	4	.701E+00	467	121	265	4	.889E+00
356	93	237	4	.701E+00	412	107	301	1	.820E-01	468	121	301	1	.220E-01
357	93	301	1	.850E-01	413	107	301	1	.830E-01	469	121	301	1	.133E+00
358	93	301	1	.810E-01	414	108	109	1	.146E+01	470	122	123	1	.115E+01
359	94	95	1	.146E+01	415	108	252	4	.701E+00	471	122	266	4	.889E+00
360	94	238	4	.701E+00	416	108	301	1	.840E-01	472	122	301	1	.420E-01
361	94	301	1	.850E-01	417	108	301	1	.830E-01	473	123	124	1	.115E+01
362	94	301	1	.810E-01	418	109	110	1	.146E+01	474	123	267	4	.889E+00
363	95	96	1	.146E+01	419	109	253	4	.701E+00	475	123	301	1	.760E-01
364	95	239	4	.701E+00	420	109	301	1	.850E-01	476	124	125	1	.129E+01
365	95	301	1	.850E-01	421	109	301	1	.830E-01	477	124	268	4	.889E+00
366	95	301	1	.810E-01	422	110	111	1	.146E+01	478	124	301	1	.940E-01
367	96	97	1	.129E+01	423	110	254	4	.701E+00	479	125	126	1	.146E+01
368	96	240	4	.701E+00	424	110	301	1	.850E-01	480	125	269	4	.701E+00
369	96	301	1	.840E-01	425	110	301	1	.830E-01	481	125	301	1	.490E-01
370	96	301	1	.800E-01	426	111	112	1	.146E+01	482	125	301	1	.860E-01
371	97	98	1	.115E+01	427	111	255	4	.701E+00	483	126	127	1	.146E+01
372	97	241	4	.889E+00	428	111	301	1	.850E-01	484	126	270	4	.701E+00
373	97	301	1	.900E-01	429	111	301	1	.830E-01	485	126	301	1	.680E-01
374	97	301	1	.930E-01	430	112	113	1	.146E+01	486	126	301	1	.860E-01
375	98	99	1	.115E+01	431	112	256	4	.701E+00	487	127	128	1	.146E+01
376	98	242	4	.889E+00	432	112	301	1	.850E-01	488	127	271	4	.701E+00
377	98	301	1	.690E-01	433	112	301	1	.830E-01	489	127	301	1	.820E-01
378	98	301	1	.123E+00	434	113	114	1	.146E+01	490	127	301	1	.850E-01
379	99	100	1	.115E+01	435	113	257	4	.701E+00	491	128	129	1	.146E+01
380	99	243	4	.889E+00	436	113	301	1	.850E-01	492	128	272	4	.701E+00
381	99	301	1	.260E-01	437	113	301	1	.830E-01	493	128	301	1	.910E-01
382	99	301	1	.149E+00	438	114	115	1	.146E+01	494	128	301	1	.840E-01
383	100	101	1	.115E+01	439	114	258	4	.701E+00	495	129	130	1	.146E+01
384	100	244	4	.889E+00	440	114	301	1	.850E-01	496	129	273	4	.701E+00
385	100	301	1	.380E-01	441	114	301	1	.830E-01	497	129	301	1	.970E-01
386	101	102	1	.115E+01	442	115	116	1	.146E+01	498	129	301	1	.830E-01
387	101	245	4	.889E+00	443	115	259	4	.701E+00	499	130	131	1	.146E+01
388	101	301	1	.920E-01	444	115	301	1	.840E-01	500	130	274	4	.701E+00
389	101	301	1	.720E-01	445	115	301	1	.830E-01	501	130	301	1	.100E+00
390	102	103	1	.129E+01	446	116	117	1	.146E+01	502	130	301	1	.830E-01
391	102	246	4	.889E+00	447	116	260	4	.701E+00	503	131	132	1	.146E+01
392	102	301	1	.124E+00	448	116	301	1	.840E-01	504	131	275	4	.701E+00

Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct	Brnh	From	To	Tag	Conduct
505	131	301	1	.101E+00	561	158	157	5	.174E+03	617	214	213	5	.174E+03
506	131	301	1	.830E-01	562	159	158	5	.174E+03	618	215	214	5	.174E+03
507	132	133	1	.146E+01	563	160	159	5	.174E+03	619	216	215	5	.174E+03
508	132	276	4	.701E+00	564	161	160	5	.174E+03	620	217	216	5	.174E+03
509	132	301	1	.100E+00	565	162	161	5	.174E+03	621	218	217	5	.174E+03
510	132	301	1	.830E-01	566	163	162	5	.174E+03	622	219	218	5	.174E+03
511	133	134	1	.146E+01	567	164	163	5	.174E+03	623	220	219	5	.174E+03
512	133	277	4	.701E+00	568	165	164	5	.174E+03	624	221	220	5	.174E+03
513	133	301	1	.970E-01	569	166	165	5	.174E+03	625	222	221	5	.174E+03
514	133	301	1	.830E-01	570	167	166	5	.174E+03	626	223	222	5	.174E+03
515	134	135	1	.146E+01	571	168	167	5	.174E+03	627	224	223	5	.174E+03
516	134	278	4	.701E+00	572	169	168	5	.174E+03	628	225	224	5	.174E+03
517	134	301	1	.910E-01	573	170	169	5	.174E+03	629	226	225	5	.174E+03
518	134	301	1	.840E-01	574	171	170	5	.174E+03	630	227	226	5	.174E+03
519	135	136	1	.146E+01	575	172	171	5	.174E+03	631	228	227	5	.174E+03
520	135	279	4	.701E+00	576	173	172	5	.174E+03	632	229	228	5	.174E+03
521	135	301	1	.820E-01	577	174	173	5	.174E+03	633	230	229	5	.174E+03
522	135	301	1	.840E-01	578	175	174	5	.174E+03	634	231	230	5	.174E+03
523	136	137	1	.146E+01	579	176	175	5	.174E+03	635	232	231	5	.174E+03
524	136	280	4	.701E+00	580	177	176	5	.174E+03	636	233	232	5	.174E+03
525	136	301	1	.680E-01	581	178	177	5	.174E+03	637	234	233	5	.174E+03
526	136	301	1	.860E-01	582	179	178	5	.174E+03	638	235	234	5	.174E+03
527	137	138	1	.146E+01	583	180	179	5	.174E+03	639	236	235	5	.174E+03
528	137	281	4	.701E+00	584	181	180	5	.174E+03	640	237	236	5	.174E+03
529	137	301	1	.490E-01	585	182	181	5	.174E+03	641	238	237	5	.174E+03
530	137	301	1	.870E-01	586	183	182	5	.174E+03	642	239	238	5	.174E+03
531	138	139	1	.146E+01	587	184	183	5	.174E+03	643	240	239	5	.174E+03
532	138	282	4	.701E+00	588	185	184	5	.174E+03	644	241	240	5	.174E+03
533	138	301	1	.240E-01	589	186	185	5	.174E+03	645	242	241	5	.174E+03
534	138	301	1	.880E-01	590	187	186	5	.174E+03	646	243	242	5	.174E+03
535	139	140	1	.146E+01	591	188	187	5	.174E+03	647	244	243	5	.174E+03
536	139	283	4	.701E+00	592	189	188	5	.174E+03	648	245	244	5	.174E+03
537	139	301	1	.900E-01	593	190	189	5	.174E+03	649	246	245	5	.174E+03
538	140	141	1	.160E+01	594	191	190	5	.174E+03	650	247	246	5	.174E+03
539	140	284	4	.701E+00	595	192	191	5	.174E+03	651	248	247	5	.174E+03
540	140	301	1	.910E-01	596	193	192	5	.174E+03	652	249	248	5	.174E+03
541	141	142	1	.178E+01	597	194	193	5	.174E+03	653	250	249	5	.174E+03
542	141	285	4	.576E+00	598	195	194	5	.174E+03	654	251	250	5	.174E+03
543	142	143	1	.178E+01	599	196	195	5	.174E+03	655	252	251	5	.174E+03
544	142	286	4	.576E+00	600	197	196	5	.174E+03	656	253	252	5	.174E+03
545	143	144	1	.178E+01	601	198	197	5	.174E+03	657	254	253	5	.174E+03
546	143	287	4	.576E+00	602	199	198	5	.174E+03	658	255	254	5	.174E+03
547	144	288	4	.576E+00	603	200	199	5	.174E+03	659	256	255	5	.174E+03
548	145	302	5	.174E+03	604	201	200	5	.174E+03	660	257	256	5	.174E+03
549	146	145	5	.174E+03	605	202	201	5	.174E+03	661	258	257	5	.174E+03
550	147	146	5	.174E+03	606	203	202	5	.174E+03	662	259	258	5	.174E+03
551	148	147	5	.174E+03	607	204	203	5	.174E+03	663	260	259	5	.174E+03
552	149	148	5	.174E+03	608	205	204	5	.174E+03	664	261	260	5	.174E+03
553	150	149	5	.174E+03	609	206	205	5	.174E+03	665	262	261	5	.174E+03
554	151	150	5	.174E+03	610	207	206	5	.174E+03	666	263	262	5	.174E+03
555	152	151	5	.174E+03	611	208	207	5	.174E+03	667	264	263	5	.174E+03
556	153	152	5	.174E+03	612	209	208	5	.174E+03	668	265	264	5	.174E+03
557	154	153	5	.174E+03	613	210	209	5	.174E+03	669	266	265	5	.174E+03
558	155	154	5	.174E+03	614	211	210	5	.174E+03	670	267	266	5	.174E+03
559	156	155	5	.174E+03	615	212	211	5	.174E+03	671	268	267	5	.174E+03
560	157	156	5	.174E+03	616	213	212	5	.174E+03	672	269	268	5	.174E+03

Brnh	From	To	Tag	Conduct
673	270	269	5	.174E+03
674	271	270	5	.174E+03
675	272	271	5	.174E+03
676	273	272	5	.174E+03
677	274	273	5	.174E+03
678	275	274	5	.174E+03
679	276	275	5	.174E+03
680	277	276	5	.174E+03
681	278	277	5	.174E+03
682	279	278	5	.174E+03
683	280	279	5	.174E+03
684	281	280	5	.174E+03
685	282	281	5	.174E+03
686	283	282	5	.174E+03
687	284	283	5	.174E+03
688	285	284	5	.174E+03
689	286	285	5	.174E+03
690	287	286	5	.174E+03
691	288	287	5	.174E+03

APPENDIX E. TASS NODAL TEMPERATURE OUTPUT

The following output summarizes the Steady State Thermal Analyzer output for the mass flow rates considered in this analysis.

TALSR(METRIC)--RUN 1. SIMPLE MODEL. MASS FLOW 149.7 kg/hr (330 lbm/hr)

Temperatures, degC

1	25.19	2	25.26	3	25.40	4	25.67	5	26.22	6	26.60
7	26.97	8	27.31	9	27.60	10	27.81	11	27.97	12	28.07
13	28.13	14	28.16	15	28.15	16	28.10	17	28.01	18	27.87
19	27.65	20	27.33	21	26.85	22	26.58	23	26.55	24	27.19
25	27.56	26	27.76	27	27.95	28	28.03	29	28.08	30	28.10
31	28.12	32	28.13	33	28.14	34	28.15	35	28.16	36	28.17
37	28.18	38	28.19	39	28.19	40	28.19	41	28.17	42	28.12
43	27.99	44	27.61	45	27.15	46	27.66	47	27.93	48	28.05
49	28.19	50	28.25	51	28.29	52	28.31	53	28.32	54	28.34
55	28.35	56	28.36	57	28.37	58	28.37	59	28.38	60	28.39
61	28.40	62	28.40	63	28.41	64	28.40	65	28.37	66	28.84
67	29.28	68	29.43	69	29.36	70	28.87	71	28.39	72	27.84
73	27.85	74	28.42	75	28.92	76	29.43	77	29.53	78	29.39
79	28.97	80	28.53	81	28.58	82	28.61	83	28.62	84	28.64
85	28.65	86	28.66	87	28.67	88	28.67	89	28.68	90	28.69
91	28.70	92	28.71	93	28.71	94	28.71	95	28.69	96	28.64
97	28.53	98	28.43	99	28.19	100	27.73	101	28.18	102	28.57
103	28.71	104	28.77	105	28.80	106	28.82	107	28.84	108	28.85
109	28.86	110	28.87	111	28.88	112	28.88	113	28.89	114	28.90
115	28.90	116	28.89	117	28.87	118	28.81	119	28.65	120	28.48
121	28.15	122	27.57	123	27.61	124	27.88	125	28.34	126	28.64
127	28.86	128	29.01	129	29.11	130	29.17	131	29.20	132	29.19
133	29.15	134	29.07	135	28.95	136	28.77	137	28.53	138	28.23
139	27.91	140	27.57	141	27.09	142	26.84	143	26.72	144	26.66
145	25.00	146	25.00	147	25.00	148	25.00	149	25.01	150	25.02
151	25.02	152	25.03	153	25.04	154	25.05	155	25.07	156	25.08
157	25.09	158	25.10	159	25.12	160	25.13	161	25.14	162	25.15
163	25.16	164	25.17	165	25.18	166	25.18	167	25.19	168	25.20
169	25.21	170	25.23	171	25.24	172	25.25	173	25.26	174	25.27
175	25.28	176	25.29	177	25.31	178	25.32	179	25.33	180	25.34
181	25.35	182	25.36	183	25.37	184	25.39	185	25.40	186	25.41
187	25.42	188	25.43	189	25.44	190	25.45	191	25.46	192	25.48
193	25.49	194	25.50	195	25.51	196	25.52	197	25.53	198	25.54
199	25.56	200	25.57	201	25.58	202	25.59	203	25.60	204	25.61
205	25.62	206	25.63	207	25.65	208	25.66	209	25.67	210	25.69
211	25.70	212	25.71	213	25.73	214	25.74	215	25.75	216	25.77
217	25.78	218	25.79	219	25.81	220	25.82	221	25.83	222	25.84
223	25.86	224	25.87	225	25.88	226	25.90	227	25.91	228	25.92
229	25.93	230	25.94	231	25.95	232	25.96	233	25.97	234	25.98
235	25.99	236	26.00	237	26.02	238	26.03	239	26.04	240	26.05
241	26.06	242	26.07	243	26.08	244	26.09	245	26.10	246	26.11
247	26.12	248	26.14	249	26.15	250	26.16	251	26.17	252	26.18
253	26.19	254	26.20	255	26.21	256	26.22	257	26.23	258	26.24
259	26.25	260	26.26	261	26.27	262	26.28	263	26.30	264	26.31
265	26.32	266	26.32	267	26.33	268	26.34	269	26.35	270	26.36
271	26.37	272	26.38	273	26.39	274	26.40	275	26.41	276	26.42
277	26.43	278	26.44	279	26.45	280	26.46	281	26.47	282	26.48
283	26.48	284	26.49	285	26.49	286	26.49	287	26.49	288	26.49
301	40.00	302	25.00								

TALSR(METRIC)--RUN 2. COMPLEX MODEL, MASS FLOW 149.7 kg/hr (330 lbm/hr)
Temperatures, degC

1	25.21	2	25.28	3	25.44	4	25.74	5	26.33	6	26.73
7	27.09	8	27.41	9	27.68	10	27.87	11	28.01	12	28.10
13	28.16	14	28.18	15	28.17	16	28.13	17	28.04	18	27.90
19	27.69	20	27.39	21	26.91	22	26.65	23	26.62	24	27.20
25	27.56	26	27.78	27	27.98	28	28.06	29	28.10	30	28.13
31	28.15	32	28.15	33	28.16	34	28.16	35	28.16	36	28.16
37	28.14	38	28.13	39	28.11	40	28.09	41	28.07	42	28.03
43	27.97	44	27.62	45	27.18	46	27.65	47	27.93	48	28.07
49	28.22	50	28.28	51	28.32	52	28.34	53	28.35	54	28.36
55	28.37	56	28.37	57	28.37	58	28.38	59	28.38	60	28.39
61	28.39	62	28.39	63	28.38	64	28.37	65	28.32	66	28.79
67	29.24	68	29.42	69	29.35	70	28.87	71	28.39	72	27.85
73	27.85	74	28.42	75	28.91	76	29.41	77	29.49	78	29.34
79	28.91	80	28.50	81	28.57	82	28.60	83	28.62	84	28.63
85	28.65	86	28.65	87	28.66	88	28.66	89	28.66	90	28.67
91	28.68	92	28.68	93	28.68	94	28.68	95	28.66	96	28.60
97	28.49	98	28.40	99	28.16	100	27.74	101	28.18	102	28.55
103	28.65	104	28.70	105	28.74	106	28.77	107	28.80	108	28.83
109	28.85	110	28.86	111	28.87	112	28.88	113	28.89	114	28.89
115	28.89	116	28.87	117	28.84	118	28.78	119	28.62	120	28.44
121	28.13	122	27.62	123	27.67	124	27.93	125	28.37	126	28.67
127	28.87	128	29.02	129	29.11	130	29.16	131	29.19	132	29.18
133	29.15	134	29.08	135	28.96	136	28.80	137	28.57	138	28.29
139	27.97	140	27.63	141	27.12	142	26.86	143	26.73	144	26.67
145	25.00	146	25.00	147	25.00	148	25.01	149	25.01	150	25.02
151	25.03	152	25.04	153	25.05	154	25.06	155	25.07	156	25.08
157	25.09	158	25.11	159	25.12	160	25.13	161	25.14	162	25.15
163	25.16	164	25.17	165	25.18	166	25.19	167	25.20	168	25.21
169	25.22	170	25.23	171	25.24	172	25.25	173	25.27	174	25.28
175	25.29	176	25.30	177	25.31	178	25.32	179	25.33	180	25.35
181	25.36	182	25.37	183	25.38	184	25.39	185	25.40	186	25.41
187	25.42	188	25.44	189	25.44	190	25.46	191	25.47	192	25.48
193	25.49	194	25.50	195	25.51	196	25.53	197	25.54	198	25.55
199	25.56	200	25.57	201	25.58	202	25.59	203	25.60	204	25.62
205	25.63	206	25.64	207	25.65	208	25.66	209	25.68	210	25.69
211	25.70	212	25.71	213	25.73	214	25.74	215	25.76	216	25.77
217	25.78	218	25.79	219	25.81	220	25.82	221	25.84	222	25.85
223	25.86	224	25.88	225	25.89	226	25.90	227	25.91	228	25.92
229	25.93	230	25.94	231	25.95	232	25.96	233	25.97	234	25.98
235	26.00	236	26.01	237	26.02	238	26.03	239	26.04	240	26.05
241	26.06	242	26.07	243	26.08	244	26.09	245	26.10	246	26.11
247	26.12	248	26.14	249	26.15	250	26.16	251	26.17	252	26.18
253	26.19	254	26.20	255	26.21	256	26.22	257	26.23	258	26.24
259	26.25	260	26.26	261	26.27	262	26.28	263	26.30	264	26.31
265	26.32	266	26.32	267	26.33	268	26.34	269	26.35	270	26.35
271	26.36	272	26.38	273	26.39	274	26.40	275	26.41	276	26.42
277	26.43	278	26.44	279	26.45	280	26.46	281	26.47	282	26.48
283	26.48	284	26.49	285	26.49	286	26.49	287	26.49	288	26.49
301	40.00	302	25.00								

TALSR(METRIC)--RUN 3. COMPLEX MODEL, MASS FLOW OF 68 kg/hr (150 lbm/hr)
Temperatures, degC

1	25.69	2	25.81	3	26.07	4	26.51	5	27.28	6	27.87
7	28.41	8	28.88	9	29.26	10	29.55	11	29.76	12	29.89
13	29.97	14	30.01	15	30.00	16	29.93	17	29.81	18	29.62
19	29.33	20	28.95	21	28.39	22	28.07	23	28.06	24	28.71
25	29.18	26	29.50	27	29.75	28	29.88	29	29.96	30	30.01
31	30.04	32	30.06	33	30.07	34	30.08	35	30.08	36	30.07
37	30.06	38	30.04	39	30.02	40	29.99	41	29.94	42	29.88
43	29.78	44	29.40	45	28.96	46	29.44	47	29.77	48	29.96
49	30.15	50	30.25	51	30.31	52	30.34	53	30.37	54	30.39
55	30.40	56	30.41	57	30.42	58	30.42	59	30.43	60	30.44
61	30.45	62	30.45	63	30.46	64	30.46	65	30.47	66	30.97
67	31.41	68	31.59	69	31.51	70	31.03	71	30.50	72	29.94
73	29.95	74	30.54	75	31.09	76	31.60	77	31.70	78	31.56
79	31.16	80	30.73	81	30.76	82	30.78	83	30.80	84	30.81
85	30.83	86	30.84	87	30.85	88	30.86	89	30.86	90	30.87
91	30.88	92	30.88	93	30.88	94	30.87	95	30.84	96	30.77
97	30.63	98	30.50	99	30.25	100	29.85	101	30.29	102	30.68
103	30.83	104	30.92	105	30.98	106	31.02	107	31.07	108	31.10
109	31.13	110	31.15	111	31.17	112	31.18	113	31.19	114	31.19
115	31.18	116	31.16	117	31.11	118	31.02	119	30.83	120	30.59
121	30.22	122	29.69	123	29.73	124	30.03	125	30.53	126	30.88
127	31.14	128	31.33	129	31.45	130	31.53	131	31.56	132	31.56
133	31.51	134	31.41	135	31.26	136	31.04	137	30.74	138	30.37
139	29.94	140	29.48	141	28.87	142	28.53	143	28.33	144	28.24
145	25.00	146	25.01	147	25.01	148	25.02	149	25.03	150	25.04
151	25.06	152	25.07	153	25.09	154	25.11	155	25.14	156	25.16
157	25.18	158	25.20	159	25.23	160	25.25	161	25.27	162	25.29
163	25.31	164	25.33	165	25.34	166	25.36	167	25.38	168	25.40
169	25.42	170	25.44	171	25.46	172	25.48	173	25.51	174	25.53
175	25.55	176	25.57	177	25.59	178	25.61	179	25.63	180	25.65
181	25.67	182	25.69	183	25.71	184	25.73	185	25.75	186	25.77
187	25.80	188	25.82	189	25.84	190	25.86	191	25.88	192	25.91
193	25.93	194	25.95	195	25.97	196	25.99	197	26.01	198	26.03
199	26.05	200	26.07	201	26.09	202	26.11	203	26.13	204	26.15
205	26.17	206	26.19	207	26.21	208	26.23	209	26.26	210	26.28
211	26.30	212	26.33	213	26.35	214	26.38	215	26.40	216	26.42
217	26.44	218	26.47	219	26.50	220	26.52	221	26.54	222	26.56
223	26.58	224	26.61	225	26.63	226	26.65	227	26.67	228	26.69
229	26.71	230	26.73	231	26.75	232	26.77	233	26.79	234	26.80
235	26.82	236	26.84	237	26.86	238	26.88	239	26.90	240	26.92
241	26.94	242	26.96	243	26.98	244	27.00	245	27.02	246	27.04
247	27.06	248	27.07	249	27.09	250	27.11	251	27.13	252	27.15
253	27.17	254	27.19	255	27.20	256	27.22	257	27.24	258	27.26
259	27.28	260	27.30	261	27.32	262	27.33	263	27.35	264	27.37
265	27.39	266	27.40	267	27.42	268	27.43	269	27.45	270	27.46
271	27.48	272	27.50	273	27.52	274	27.54	275	27.55	276	27.57
277	27.59	278	27.61	279	27.63	280	27.64	281	27.66	282	27.67
283	27.68	284	27.69	285	27.69	286	27.70	287	27.70	288	27.70
301	40.00	302	25.00								

TALSR(METRIC)--RUN 4. COMPLEX MODEL, MASS FLOW OF 272.2 kg/hr (600 lbm/hr)

Temperatures, degC

1	25.07	2	25.11	3	25.21	4	25.41	5	25.87	6	26.14
7	26.38	8	26.61	9	26.80	10	26.93	11	27.03	12	27.09
13	27.13	14	27.14	15	27.14	16	27.11	17	27.05	18	26.95
19	26.80	20	26.57	21	26.19	22	25.99	23	25.95	24	26.43
25	26.70	26	26.85	27	26.99	28	27.04	29	27.07	30	27.09
31	27.10	32	27.10	33	27.10	34	27.10	35	27.10	36	27.10
37	27.09	38	27.08	39	27.07	40	27.05	41	27.04	42	27.02
43	26.99	44	26.70	45	26.30	46	26.72	47	26.94	48	27.03
49	27.15	50	27.19	51	27.21	52	27.22	53	27.23	54	27.23
55	27.24	56	27.24	57	27.24	58	27.24	59	27.24	60	27.24
61	27.25	62	27.25	63	27.24	64	27.21	65	27.14	66	27.53
67	27.95	68	28.10	69	28.05	70	27.62	71	27.23	72	26.76
73	26.76	74	27.25	75	27.65	76	28.09	77	28.15	78	28.01
79	27.61	80	27.26	81	27.35	82	27.38	83	27.40	84	27.41
85	27.42	86	27.42	87	27.43	88	27.43	89	27.43	90	27.43
91	27.44	92	27.44	93	27.44	94	27.44	95	27.43	96	27.39
97	27.30	98	27.24	99	27.05	100	26.65	101	27.06	102	27.36
103	27.42	104	27.46	105	27.48	106	27.50	107	27.52	108	27.54
109	27.55	110	27.56	111	27.57	112	27.57	113	27.58	114	27.58
115	27.58	116	27.57	117	27.56	118	27.51	119	27.39	120	27.27
121	27.03	122	26.58	123	26.63	124	26.83	125	27.20	126	27.43
127	27.58	128	27.68	129	27.75	130	27.78	131	27.80	132	27.80
133	27.77	134	27.72	135	27.64	136	27.52	137	27.35	138	27.14
139	26.92	140	26.68	141	26.27	142	26.09	143	26.00	144	25.97
145	25.00	146	25.00	147	25.00	148	25.00	149	25.01	150	25.01
151	25.01	152	25.02	153	25.03	154	25.03	155	25.04	156	25.05
157	25.06	158	25.06	159	25.07	160	25.08	161	25.08	162	25.09
163	25.10	164	25.10	165	25.11	166	25.11	167	25.12	168	25.12
169	25.13	170	25.14	171	25.14	172	25.15	173	25.16	174	25.16
175	25.17	176	25.18	177	25.18	178	25.19	179	25.20	180	25.20
181	25.21	182	25.22	183	25.22	184	25.23	185	25.24	186	25.24
187	25.25	188	25.26	189	25.26	190	25.27	191	25.28	192	25.29
193	25.29	194	25.30	195	25.31	196	25.31	197	25.32	198	25.33
199	25.33	200	25.34	201	25.35	202	25.35	203	25.36	204	25.37
205	25.37	206	25.38	207	25.39	208	25.39	209	25.40	210	25.41
211	25.42	212	25.43	213	25.44	214	25.45	215	25.45	216	25.46
217	25.47	218	25.47	219	25.48	220	25.49	221	25.50	222	25.51
223	25.52	224	25.53	225	25.53	226	25.54	227	25.55	228	25.55
229	25.56	230	25.57	231	25.57	232	25.58	233	25.59	234	25.59
235	25.60	236	25.61	237	25.61	238	25.62	239	25.62	240	25.63
241	25.64	242	25.65	243	25.65	244	25.66	245	25.66	246	25.67
247	25.68	248	25.68	249	25.69	250	25.70	251	25.70	252	25.71
253	25.72	254	25.72	255	25.73	256	25.74	257	25.74	258	25.75
259	25.76	260	25.76	261	25.77	262	25.77	263	25.78	264	25.79
265	25.79	266	25.80	267	25.80	268	25.81	269	25.81	270	25.82
271	25.82	272	25.83	273	25.84	274	25.84	275	25.85	276	25.86
277	25.86	278	25.87	279	25.88	280	25.88	281	25.89	282	25.89
283	25.90	284	25.90	285	25.90	286	25.90	287	25.90	288	25.90
301	40.00	302	25.00								

TALSR(METRIC)--RUN 5. COMPLEX MODEL, MASS FLOW OF 362.9 kg/hr (800 lbm/hr)

Temperatures, degC

1	25.04	2	25.07	3	25.14	4	25.31	5	25.72	6	25.93
7	26.13	8	26.32	9	26.47	10	26.59	11	26.67	12	26.72
13	26.75	14	26.76	15	26.75	16	26.73	17	26.68	18	26.60
19	26.48	20	26.28	21	25.95	22	25.77	23	25.73	24	26.17
25	26.39	26	26.51	27	26.63	28	26.67	29	26.69	30	26.71
31	26.71	32	26.71	33	26.72	34	26.72	35	26.72	36	26.71
37	26.70	38	26.69	39	26.68	40	26.67	41	26.66	42	26.65
43	26.63	44	26.37	45	26.00	46	26.39	47	26.59	48	26.65
49	26.75	50	26.79	51	26.80	52	26.81	53	26.82	54	26.82
55	26.82	56	26.82	57	26.82	58	26.83	59	26.83	60	26.83
61	26.83	62	26.83	63	26.82	64	26.80	65	26.72	66	27.06
67	27.45	68	27.59	69	27.55	70	27.15	71	26.81	72	26.38
73	26.38	74	26.82	75	27.17	76	27.58	77	27.63	78	27.50
79	27.12	80	26.81	81	26.91	82	26.93	83	26.95	84	26.96
85	26.97	86	26.97	87	26.97	88	26.97	89	26.97	90	26.98
91	26.98	92	26.98	93	26.99	94	26.99	95	26.98	96	26.95
97	26.86	98	26.82	99	26.66	100	26.28	101	26.66	102	26.93
103	26.97	104	27.00	105	27.01	106	27.03	107	27.05	108	27.06
109	27.07	110	27.08	111	27.09	112	27.09	113	27.09	114	27.10
115	27.10	116	27.09	117	27.08	118	27.05	119	26.94	120	26.84
121	26.63	122	26.23	123	26.28	124	26.45	125	26.78	126	26.97
127	27.10	128	27.19	129	27.24	130	27.27	131	27.28	132	27.28
133	27.26	134	27.22	135	27.15	136	27.04	137	26.90	138	26.73
139	26.54	140	26.35	141	25.98	142	25.83	143	25.76	144	25.74
145	25.00	146	25.00	147	25.00	148	25.00	149	25.00	150	25.01
151	25.01	152	25.02	153	25.02	154	25.03	155	25.03	156	25.04
157	25.04	158	25.05	159	25.05	160	25.06	161	25.07	162	25.07
163	25.07	164	25.08	165	25.08	166	25.09	167	25.09	168	25.09
169	25.10	170	25.10	171	25.11	172	25.12	173	25.12	174	25.13
175	25.13	176	25.14	177	25.14	178	25.15	179	25.15	180	25.16
181	25.16	182	25.17	183	25.17	184	25.18	185	25.18	186	25.19
187	25.19	188	25.20	189	25.20	190	25.21	191	25.21	192	25.22
193	25.22	194	25.23	195	25.24	196	25.24	197	25.25	198	25.25
199	25.26	200	25.26	201	25.27	202	25.27	203	25.28	204	25.28
205	25.29	206	25.29	207	25.30	208	25.30	209	25.31	210	25.32
211	25.32	212	25.33	213	25.34	214	25.34	215	25.35	216	25.36
217	25.36	218	25.37	219	25.37	220	25.38	221	25.39	222	25.39
223	25.40	224	25.41	225	25.41	226	25.42	227	25.42	228	25.43
229	25.43	230	25.44	231	25.44	232	25.45	233	25.45	234	25.46
235	25.46	236	25.47	237	25.47	238	25.48	239	25.48	240	25.49
241	25.49	242	25.50	243	25.50	244	25.51	245	25.51	246	25.52
247	25.52	248	25.53	249	25.53	250	25.54	251	25.54	252	25.55
253	25.55	254	25.56	255	25.56	256	25.57	257	25.57	258	25.58
259	25.59	260	25.59	261	25.60	262	25.60	263	25.61	264	25.61
265	25.62	266	25.62	267	25.62	268	25.62	269	25.63	270	25.63
271	25.64	272	25.64	273	25.65	274	25.65	275	25.66	276	25.66
277	25.67	278	25.68	279	25.68	280	25.68	281	25.69	282	25.69
283	25.70	284	25.70	285	25.70	286	25.70	287	25.70	288	25.70
301	40.00	302	25.00								

LIST OF REFERENCES

Burmeister, L. C., (1993). Convective Heat Transfer, 2nd Ed., John Wiley & Sons Book Company, New York.

Garrett, S. L., (1992). <u>ThermoAcoustic Life Sciences Refrigerator:</u> *Heat Exchanger Design and Performance Prediction,* NASA Technical Report.

Hamming, R., (1973). *Numerical Methods for Scientists and Engineers*, Dover Publishing Co., New York.

Incropera, F. P., and DeWitt, D. P. (1985). *Fundamentals of Heat and Mass Transfer,* 2nd Ed., John Wiley & Sons Book Company, New York.

Kays, W. M., and London, A. L. (1984) *Compact Heat Exchangers,* 3rd Ed., McGraw-Hill Book Company, New York.

Kern, D. Q., and Kraus, A. D. (1972). *Extended Surface Heat Transfer,* McGraw-Hill Book Company, New York.

Kraus, A. D. (1961). Efficiency of the Cold Plate Heat Exchanger, Proc. Natl. Aeronaut. Electronics Conf., Dayton, Ohio, 381.

Kraus, A. D. (1962). Optimization of the Cold Plate Heat Exchanger, Proc. Natl. Aeronaut. Electronics Conf., Dayton, Ohio, 78.

Kraus, A. D., Snider, A. D., and Doty, L. F. (1978). An Efficient Algorithm for Evaluating Arrays of Extended Surfaces, *J. Heat Transfer*, 100, 288.

Kraus, A. D. (1982). *Analysis and Evaluation of Extended Surface Thermal Systems,* Hemisphere Publishing Co., New York.

Kraus, A. D. (1989). *Steady State Thermal Analyzer User's Guide,* InterCept Software, San Diego.

Pieper, R. J., and Kraus, A. D. (1995). Cold Plates with Asymmetric Heat Loading Part I - The Single Stack, *Proceedings of the ASME Inetrpack'95 Conference, Advances in Electronic Packaging, Vol. 10-2*, ASME, pp 871-876, March 1995

Sieder, E. N., and Tate, G. E., (1936). *Ind. Eng. Chem.*, 28, 1429.

Snider, A. D., and Kraus, A. D. (1981). A General Extended

Surface Analysis Method, *J. Heat Transfer*, 103, 699.

Vainshtein, P., Fichman, M., and Gutfinger, C. (1995). Acoustic enhancement of heat transfer between two parallel plates, *Int. J. Heat Mass Transfer*, Vol. 38, No. 10, pp 1893.

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